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HELENA, MONTANA

SOLID WASTES BETTERMENT PROJECT

FINAL REPORT

NOVEMBER, 1972

FOR

THE CITY OF HELENA, MONTANA

OMAS, DEAN & HOSKINS, INC.
ENGINEERS
GREAT FALLS - BOZEMAN, MONTANA

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Bureau of Solid Waste Management
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Thomas, Dean & Hoskins, Inc.
Engineers
Great Falls - Bozeman, Montana

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SECTION I - INTRODUCTION

PROGRAM DESCRIPTION

The City of Helena conducted a three year evaluation of the operation of their solid waste facilities including storage, collection, haul, and disposal. This program began on June 1, 1969, and ended on June 30, 1972. Financing of the study was through a Federal Grant from the Department of Health, Education and Welfare* with a portion of the funding from the Helena Model Cities program. The City of Helena's share of the cost was in the way of equipment rental and other non-cash contributions.

The purpose of the Helena Solid Wastes Project was to demonstrate the benefits derived from certain improvements to the Helena Solid Waste System. The project objectives were:

A. To purchase, install, and maintain bulk containers as justified to reduce costs and improve sanitary and environmental conditions.

B. To purchase, install, and maintain residential storage containers in a selected portion of the City to reduce operating costs and improve sanitary and environmental conditions.

C. To develop a sanitary landfill site at a location centrally located within the City.

D. To establish a detailed system of recordkeeping and cost accounting.

The selected residential study area received uniform types and sizes of garbage cans and racks. Homeowners with curb-side pickup also received

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* Now "Office of Solid Waste Management Programs, Environmental Protection Agency".

plastic liner bags for curb-side placement. These storage facilities replaced many different types of containers and racks.

The commercial sites selected under the study received bulk containers to replace the original garbage cans.

A new sanitary landfill site located near the downtown area of Helena was placed in operation.

Operational costs of the solid waste collection, haul, and disposal were being recorded through a cost accounting system which was expanded in the second year of the project to give a more detailed breakdown. Cost data was kept separately for residential, commercial, and bulky waste operations.

GENERAL INFORMATION

The City is built on hilly terrain with mountains extending into the south end of the City. The north portion of the City has flatter terrain. Some of the streets in Helena have 5-10% grades. In the winter when the streets are icy some collection trucks are rerouted in order to serve the homes in the hilly areas. The residential study area selected consists of both hilly and flat areas. The alleys in the study area are 16 feet - 20 feet in width.

The normal annual precipitation for Helena is only 10.9 inches per year with an average of 45 inches of snowfall per year. There are only 30 days per year on the average when the precipitation, including rain or snow, exceeds 0.10 inch in depth. Precipitation amounts are seldom severe enough in Helena to adversely affect the solid waste collection operation.

The 1970 population of Helena was 22,730. The City has 8,037 year around housing units and 312 commercial establishments.

SECTION II - SUMMARY

The City of Helena established a detailed system of recordkeeping and cost accounting as a basis for analyzing the operation of their entire solid waste program. During a three year period, an evaluation was made of various changes in their operation. These changes included improvements to the residential and commercial storage. The residential, commercial, and bulky waste collection routes were reorganized. A new landfill site was established in an area centrally located within the City. The following table itemizes the amount of refuse collected and disposed of along with the operating costs for the various elements of Helena's solid waste system. This table is based on statistics collected after the operation had been reorganized, and it is felt that the operating costs represent those of a well managed and efficient solid waste program.

STATISTICAL SUMMARY OF HELENA SOLID WASTE OPERATION
AVERAGE AMOUNTS FOR PERIOD FROM DECEMBER, 1970 TO MAY, 1972

Residential Collection	639.5 tons/mo
Commercial Collection	197.5 tons/mo
Bulky Waste Collection	93.9 tons/mo
Total City Collection	930.9 tons/mo
Private Haul	717.6 tons/mo
Total Tons Disposed	1,648.5 tons/mo*
Total Collected Refuse	2.73 lbs/capita/day
Residential Collection	5.30 lbs/residence/day

* Excludes Demolition

STATISTICAL SUMMARY OF HELENA SOLID WASTE OPERATION
(Continued)

Commercial Collection		42.4 lbs/service/day
Total Disposed *		4.84 lbs/capita/day
Collection Time on Route**		138.5 man-minutes/ton
Haul Time		21.4 man-minutes/ton
Collection Cost/Ton	$ 9.34	
Hauling Cost/Ton	3.43	
Repair and Maintenance Cost/Ton	0.67	
Depreciation Cost/Ton	0.68	
Total Collection and Haul Cost/Ton	$14.12	(for 930.9 Tons)
Disposal Operation Cost/Ton	$ 1.18	
Disposal Repair and Maintenance Cost/Ton	0.17	
Depreciation Cost/Ton	0.49	
Total Disposal Cost/Ton	$ 1.84	(for 1,648.5 tons/month)

* Includes small portion of outside city limit refuse produced by unknown population which could somewhat reduce figure shown here.

** "Collection Time on Route" includes approximately 10% curb-side collections versus 90% alley collections with negligible amount of backyard carry-out collections.

During the three years of the study program, a 9% reduction in the collection and haul cost and a 21% reduction in the disposal cost was realized. This reduction in cost was realized during the period when the salaries of

the City employees were increased approximately 5% per year. These cost reductions can be attributed to improved operational procedures, rerouting of collection trucks, improved crew attitude, and a more centrally located landfill.

The collection costs, indicated in the table shown on the preceding pages, include the portion of crew labor costs, truck operational costs, and overhead costs applicable to the collection phase of operation. Labor costs include direct wages, overtime pay, and fringe benefits. Operational costs for the trucks include oil, lubrication, and gasoline costs proportioned to apply to the collection phase of operation. Overhead costs are also proportioned and applied here to the collection cost. The method of arriving at these costs is explained in the "Monthly Operating Cost Summary Outline" in Section VII of this report.

The haul costs include the time the trucks are going to and from the shop and the sanitary landfill and the non-productive time, such as coffee breaks. These costs are also derived as indicated in Section VII of this report.

Private haul average tonnages shown include refuse delivered to the landfill by homeowners or commercial establishments hauling their own refuse to the site. This does not include the demolition waste hauled to the sanitary landfill as a result of the Helena Urban Renewal Program. Demolition waste figures are indicated later in the report.

New storage facilities were provided in the selected residential study area. Where suitable storage sites were available, the homeowners received City owned and maintained storage racks and cans. The remainder of the

study area received plastic bags for curb-side collection. The plastic bag supply was limited and after depletion of the supply, the standard containers were again set out for curb-side collection. The use of standardized City owned racks and cans indicated that there was a reduction in collection time of approximately 13%. However, collection efficiencies improved throughout the entire City and not just in this one area. Therefore, these savings in collection time do not justify the City providing and owning storage facilities for the individual homeowner. Plastic bags were later provided in another study area for a very brief evaluation. This evaluation indicated the collection time was reduced by 50% when all residents used plastic sacks. This was in an area requiring curb-side collection. Even where there was alley collection, it is felt that there would be substantial savings in the use of plastic sacks. The cost of the plastic sacks could be justified through the savings in collection costs.

Prior to this project, there were no bulk containers in the City of Helena. Bulk containers of primarily two cubic yard capacity (four of one cubic yard capacity) were provided for all commercial services that previously required more than 1 minute to service 32 and 55 gallon containers. Location of the storage site had to be suitable for the container servicing. By providing these bulk containers, the collection time was reduced by 33%. It is felt that bulk containers are a worthwhile investment, not only from an efficiency standpoint but also for sanitary and environmental considerations.

The City of Helena provides twice a week collection in residential areas and a six day per week collection for commercial services. The City also provides collection of bulky wastes by a separate crew. The City will collect all refuse within the City. During this project, the collection crews were reorganized and new routes established for each crew. Residential services were generally removed from the commercial routes. The residential collection crews were routed to make all collection within four days each week. The fifth day is used to collect bulky wastes, to police the collection area, and to provide maintenance of storage and collection equipment. This reorganization proved most successful for Helena. Changing conditions within any City make it desirable to re-evaluate collection routes on a continuing basis and make changes as may be necessary.

During this project, a new sanitary landfill operation was started in a developed area centrally located within the City. The location reduced the haul time from the collection routes. Another purpose of using this site was to reclaim a low area that had ponding water and was subject to flooding. A new storm drain was installed to provide adequate drainage through and around the landfill. Upon completion of landfill at the site, the area will be developed for park and recreational purposes. The site was fenced and a scale installed. An attendant weighed all refuse that came into the site whenever the site was open. Because of the location within a developed area, a model operation was necessary. Extensive fencing was used to control papers. However, it was not possible to prevent papers from escaping at all

times. During the periods of high winds in excess of 30 or 40 mph, papers would soar over a 10 foot high portable fence placed adjacent to the fill area. However, this did not prove to be a serious problem.

Initially a bulky waste container was placed at the gate when the site was closed. This did not prove satisfactory. The container was damaged by disposal of large bulky items within the container. The people would often dump refuse along side the container when it was not even full. Toward the end of the project, the City removed the container and found they had less litter than when they had a container at the site. The City felt that with the extensive collection service provided, there was no need for people within the City to be bringing their refuse to the site.

A study was made of the ground water contamination. This study indicated that there was no evidence of any effect on the ground water in the surrounding area.

The density of the landfill was measured to be 900 pounds per cu. yd. Acceptance of the area was evidenced by the beginning of construction of a Y.M.C.A. facility immediately adjacent to the landfill operation.

The cost accounting system that was adopted by the City was one provided by the U.S. Environmental Protection Agency. During the three year period, changes were made in the format by which data was collected. This recordkeeping provided the basis for evaluating the entire system. For example, a 1962 loader was replaced with a 1971 loader. This reduced the operation cost of the loader from $2.44 an hour to $1.43 an hour. New

collection trucks and packers showed similar reduction in operation costs over the older models that have been in operation for a number of years.

A good management program is, of course, dependent on the personnel involved. At the outset of the program, the City of Helena hired a new manager for the solid waste department. The workmen within the department were initially reluctant to change. However, the new manager was able to stimulate the interest of the workmen. The men responded with new pride in their work and provided a better service at a reduced operating cost. Without the cooperation of these workmen, improvements would not have been possible. Questionnaires mailed to citizens within the City showed an overwhelming endorsement of the improvements that were made by the City. The management program included safety meetings which were held monthly. The resulting safety record is indicative of the success of the program. During the first full year the refuse department had 17 accidents reported, of which 12 were lost time accidents. They also had 2 vehicle accidents. During the second year of the safety program, there were 7 accidents reported, 3 of which were lost time accidents, and there were no vehicle accidents. The City has expanded the recordkeeping on the equipment by instigating a computerized evaluation of the operation of all equipment within the City. The solid waste department plans to continue using the other records that have been started under this program. However, some of the summary sheets that were quite time consuming to fill out, will not be done on a monthly basis but will probably be completed on an annual basis.

The City has used the record system as a basis to establish a new charge rate for the entire City. They have established a residential rate which is proportionate to the volume of refuse being produced by the average resident. The rate is $3.00 per month with an average volume of 358 pounds per single family residence. They have made measurements on each individual commercial establishment and established their rate accordingly. The City is encouraging all citizens to use plastic bags and is considering providing bags at no cost for the residential services. The City feels that they have increased the overall efficiency of their solid waste operation and are providing a better service than they were at the beginning of the management program.

SECTION III - SOLID WASTE COLLECTION

GENERAL

The City of Helena provides residential, commercial, and bulky waste collection service for all residents and businesses of Helena. The amount of industrial waste is negligible.

The data contained in this report is based largely on cost accounting records maintained by the City. The accounting system is discussed in Section VII. Some of the forms were changed on December 1, 1970. Because of this change in data available, much of the statistical information has been separated to show data collected before and after this change.

The following table gives the weight of refuse collected and disposed of under various categories. The new landfill site was placed in operation in October, 1970.

TABLE NO. 1
AVERAGE SOLID WASTE QUANTITIES

	Nov. 1969 thru Nov. 1970	Dec. 1970 thru May 1972
Residential Collection	536.5 tons/mo*	639.5 tons/mo
Commercial Collection	233.3 tons/mo*	197.5 tons/mo
Bulky Waste Collection	124.2 tons/mo*	93.9 tons/mo
Total Collected	890.8 tons/mo	930.9 tons/mo
Private Haul	879.0 tons/mo	717.6 tons/mo
Demolition Waste Disposed		1,981.2 tons/mo**
Total Tons Disposed***	1,769.8 tons/mo	1,648.5 tons/mo
Total Collected Refuse	2.61 lbs/capita/day	2.73 lbs/capita/day
Residential Collection	4.45 lbs/residence/day	5.30 lbs/residence/day
Commercial Collection	49.8 lbs/service/day	42.2 lbs/service/day
Total Disposed***	5.19 lbs/capita/day	4.84 lbs/capita/day

* June, 1970 thru Nov., 1970
** Average - June, 1971 thru May, 1972
*** Excludes demolition waste

Table No. 1 indicates that the amount of residential collection increased while the commercial and bulky waste collection decreased during the latter portion of the period that records were kept. This change is due primarily to the reorganization of the routing as discussed later in this report. It will be noted that the total amount of refuse increased somewhat during this period. This is consistent with national trends.

At the beginning of this study in 1969 there were three residential collection crews and two commercial collection crews. The collection operation has been reorganized to one commercial crew and four residential crews. The 1969 routes that were classified as commercial routes actually included residential pickups on their routes. By eliminating the majority of these residential stops on the commercial routes and combining the commercial stops it was possible to collect all the commercial refuse on one route. A 20 cubic yard mechanical packer collection vehicle was purchased to replace a 16 cubic yard packer previously being used on this commercial route.

RESIDENTIAL COLLECTION

The residential collection crews pick up mostly domestic waste such as household garbage. They also collect yard trimmings and leaves if they are placed in bags, and other small amounts of rubbish. However, if the yard trimmings and rubbish amount to a large quantity they are left for the bulky waste collection trucks. Open burning of refuse has not been allowed in Helena since June 18, 1969.

Residential collection is made twice per week by crews consisting of one driver and two pickup men. In 1970 the crews went to a standard 40 hour work week, instead of the incentive type work week previously in effect. The incentive type operation caused problems with damaging refuse containers, leaving litter in the alleys, and an above average accident rate.

All residential collection crews were rerouted after the new landfill was placed in operation during October of 1970. The new landfill reduced the round trip haul distance by about 2-1/2 miles. The routes are now scheduled so that each crew works a collection route 4 days per week. During the fifth work day of each week, the crews police their collection routes, make repairs to containers they may have damaged, and/or provide some collection of bulky wastes that they were not able to pick up during their normal collection. One crew also fills in for the commercial collection crew since commercial collection is provided 6 days per week. The City feels that the regular collection routing on a 4 day basis has proved very satisfactory because of the flexibility. Holidays do not require overtime or a substandard collection during the week. The crews are able to improve the overall appearance of the City by picking up spilled refuse, blowing papers, or other debris that may have resulted from vandalism, dogs, or poor storage practices on the part of the resident.

During 1970-71, drivers of collection vehicles received salaries of $500.00 per month. The collectors or pickup men on the crews were paid $470.00 per month. Salaries for 1971-72 were increased to $525.00 and $500.00 for drivers and collectors respectively.

The trucks used on the residential collection routes are indicated in Table No. 2 on page 15.

The 1962 Chevrolet and the 1950 International are used only when the regular route vehicles are being serviced or repaired.

Total residential truck mileages vary from 22 to 27 miles per day. This includes haul, disposal, and route mileages.

Section VII, Project Cost Accounting, summarizes the detailed records that were kept with relation to all phases of the solid waste system. Some of the significant figures as contained in this section show that the amount of refuse collected was 2.61 pounds per capita per day during the first year of recordkeeping and it increased to 2.73 pounds per capita per day during the last 18 months records were kept. The number of pounds collected per residence per day was 5.30. The collection crews took 2.46 man minutes per residential storage area serviced to collect and haul the refuse. Two collections were generally made for each residence during the week. The crews collected from an average of 250 residences per day. Average cost per ton for only residential collection and haul was $13.67 for the last 18 months. The average collection time for all residential crews during the entire period was 132.8 man minutes per ton. The section on residential storage contains additional data concerning the time required for collection on one specific route that was selected for further study. This route included some improvements or changes in the method of residential storage.

TABLE NO. 2
EQUIPMENT INVENTORY

Truck No.	Type	Capacity	Bulk Container Lift	Model Year	Mfg. Name	Date of Purchase	Purchase Price	Est. Life	Annual Depreciation	Monthly Depreciation
RESIDENTIAL AND COMMERCIAL EQUIPMENT										
91	Garwood	20 C.Y.	Yes	1971	Dodge	1971	$20,988	5	$4,198	$350
27	Leach	16 C.Y.	Yes	1969	Dodge	Dec. '68	$ 9,288	5	$1,858	$155
31	Heil	16 C.Y.	Yes	1964	Ford	--	$8,263	--	0	0
89	Leach	20 C.Y.	Yes	1960	IHC	--	Donated	--	0	0
THE FOLLOWING ARE USED IN CASE OF EMERGENCY:										
43	Heil	16 C.Y.	No	1962	Chevy	--	$ 8,281	--	0	0
28	Leach	16 C.Y.	No	1950	IHC	--	$ 8,500	--	0	0
BULKY WASTE EQUIPMENT										
18	Flatbed	1 Ton	--	1970	Ford	1970	$ 3,793	5	$758	$63
16	Flatbed*	1 Ton	--	1970	Ford	1970	$ 3,793	5	$758	$63

*Truck #16 is now for standby use only.

COMMERCIAL AND BULKY WASTE COLLECTION

Truck #91 is used for both commercial and residential collection. Some commercial sites are serviced six nights per week while others are serviced less often depending on the amount of refuse. To avoid traffic, collection is made between 4:00 P.M. and midnight. No collection is made on Sunday. The three-man commercial route crew works a standard 40 hour work week with one of the residential crews filling in on the sixth night.

The commercial route length including haul varies from 23 to 27 miles per day depending on the storage sites to be serviced.

Two bulky waste collection routes covered the entire City on a continuous basis prior to August 1, 1971. The two-man crews collected the material that was not normally collected on the residential and commercial routes. The frequency of collection varied with the amount of refuse generated at each site. These crews also collected bulky waste upon request by any resident.

During 1971 some of the commercial pickups were eliminated by assigning this work to the bulky waste crews. These changes were made because of the inefficiency in handling uncrushed cardboard boxes in a mechanical packer truck. The bulky waste crews can crush the boxes and haul them on their flat bed trucks.

After August 1, 1971, one bulky waste collection crew and vehicle was taken off the route. Only one bulky waste vehicle with a two-man crew now serves the entire City. The residential collection crews still handle small amounts of bulky waste on their routes.

During 1970-71, drivers of collection vehicles received salaries of $500.00 per month. The collectors or pickup men on the crews were paid $470.00 per month. Salaries for 1971-72 were increased to $525.00 and $500.00 for drivers and collectors respectively.

Route lengths vary from day to day for the truck, with a range of 24 to 35 miles per day depending on the rubbish quantities at the storage sites. The truck route begins at one end of the City and proceeds through the entire City before starting the route again.

In the fall of 1970 a new disposal site located within the City was placed into operation. All refuse now goes to this site except junk auto hulks.

Table No. 3 on page 18 summarizes the operating records that were kept on the collection operation.

Prior to November 1970 no separate records were kept for residential, commercial, and bulky waste collection. It is noted in Table No. 3 that the total cost of collection and haul for all three types of collection decreased from $15.56 during the first period of record to $14.12 during the last 18 months. This decrease is due in part to the relocation of the landfill site which decreased the average haul by 2-1/2 miles. The actual haul cost decreased from $3,670 to $3,193 per month. The tons collected increased from 890.8 to 930.9 tons per month during this period. There was a substantial reduction in the cost of repair and maintenance from $1,203 to $624 per month. This reduction in repair and maintenance can be attributed to the

TABLE NO. 3

COLLECTION OPERATION RECORDS

Dec. 1970-May 1972	Nov. 1969-Nov. 1970 All Collection Crews	Dec. 1970-May 1972 All Collection	Dec. 1970-May 1972 Residential	Commercial	Bulky
Tons Per Month	890.8	930.9	639.5	197.5	93.9
Collection Cost/Ton	$9.77	$9.34	$9.15	$7.63	$14.31
Hauling Cost/Ton	$4.12	$3.43	$3.20	$2.57	$ 6.78
Repair & Maintenance Cost/Ton	$1.35	$0.67	$0.83	$0.26	$ 0.46
Depreciation	$0.32	$0.68	$0.49	$0.97	$ 0.13
Collection & Haul Total Cost/Ton	$15.56	$14.12	$13.67	$11.42	$21.68
Collection Time On Route MM/Ton	150.0	138.5	132.8	117.7	220.9
Haul Time MM/Ton		21.4	21.3	15.4	33.5
Paid Time MM/Ton		189.6	184.9	151.1	302.9
% of Time On Route	73.5		76.9	77.2	72.8

Note MM/Ton - Man Minutes Per Ton

new packer that was put in operation in March of 1971. The packer is used for two shifts per day, one for residential and the other for commercial collection. The depreciation of the packer was pro-rated on the basis of the amount of time spent on commercial and residential collection. The packer was used for five shifts per week on residential and six shifts per week on commercial. All vehicle depreciation was on a 5 year straight line basis. Any vehicle over five years old was considered to have no value. The new packer increased the depreciation for collection from $3,382 to $7,572 per year and the cost per ton from $0.32 to $0.68. However, the increase in depreciation was more than offset by the decrease in repair and maintenance cost from $1.35 per ton to $0.67 per ton.

There was a modest decrease in the collection operating costs from $9.77 to $9.34. This was due primarily to increased efficiency through reorganization of residential, commercial, and bulky waste collection routes. The cost for route maintenance (each crew devotes one day per week to picking up litter on their route with no collections scheduled for that day) is included in the collection cost per ton shown. If a separate day was not set aside for route maintenance, this work would be accomplished on the regular collection days. It should also be noted that the costs were decreased despite increased costs in labor during each year of operation. The increased labor cost was approximately 5% per year. Time for collection of all forms of waste decreased from 150 man minutes to 138.5 man minutes per ton.

SECTION IV - RESIDENTIAL STORAGE

PURPOSE

A residential study area was selected in Helena to demonstrate the effects of improving the refuse storage facilities. (See location map in appendix of this report.) The residential area chosen to receive these facilities was one that had substandard storage. The storage containers consisted of 20, 30, and 55 gallon barrels; 32 gallon galvanized containers; and other varying types; many in poor condition without lids. Racks were broken down or non-existent at many sites. The layout of the streets, curbs, and alleys in the area are representative of the City as a whole.

In this area the substandard residential storage units were replaced with a metal rack and two galvanized garbage cans. The objective was to observe and record the crew efficiencies, sanitation conditions, and esthetics of the storage sites before and after making the improvements. (See photos at the end of this section.)

STUDY AREA IMPROVEMENTS

The size of the study area chosen was sufficient to obtain good study data and yet not so large as to limit personal contact with each homeowner. There are 495 occupied dwelling units in the area. The total area covers approximately 50 square blocks. This amounts to a density of about 10 dwelling units per block. The collection route length within the study area is 6.3 miles.

One collection crew serves the entire study area. All of the refuse generated by this area can normally be collected in one packer load.

Personal contact was made with every homeowner in the study area to discuss the objectives of the project, how it affected them, and to request their cooperation.

PROJECT INFORMATION COLLECTED

An observation of each storage site was made to determine the site condition prior to placement of the new facilities. The information collected on each individual refuse storage site included the number, type, and condition of the containers; the type and conditions of the existing racks; the littering and overall conditions of the storage site; and a picture of the site. A summary of the data taken is shown in Table No. 4 on page 22.

To select a garbage can rack most suitable for this area, existing racks in use around Helena and other cities were observed. The type of rack selected has a flip-top frame and holds two garbage cans. (See photos at end of this section.) Arrangements were made with Helena Industries, a non-profit corporation formed under the Model Cities Program, to construct and furnish these rack and can combinations. Each completed unit, including two garbage cans, cost $40.00, delivered to the City. Helena Industries supplied 218 completed units. All were placed in the residential study area by the end of November, 1970.

Those storage sites that had adequate racks and containers did not receive new units. A total of 190 homes received the new rack and can unit with some homes receiving more than one unit.

TABLE NO. 4

RESIDENTIAL CONTAINER STORAGE SITE SURVEY

EXISTING CONDITIONS

February - March, 1970

Occupied Dwelling Units	495
Total Number of Racks Present	170
Number of Racks Fitting City Codes	110
% Unacceptable	35
Total Number of Cans Present*	504
Number of Cans Fitting City Codes	258
% Unacceptable	48
Total Number of Lids Present	323
Number of Lids Fitting City Codes	237
% Unacceptable	26
Total Cans Present	504
Total Lids Present	323
% of Cans Without Lids	36
Total Number of Cans Fitting Codes	258
Total Number Lids Fitting Codes	237
% of "Good" Cans Without Lids	8
% of Littered Sites	21

* All occupied dwelling units have a minimum of one refuse container.

Racks and cans could not be used at homes with curb-side collection. For a six month experimental period, July, 1970 to December, 1970, these homes were supplied with plastic bags. On collection day the homeowners took the bags from their cans, securely tied the bags, and set them at curb-side for collection. Cans and racks were located off-street at a site selected by the homeowner. (See photos at end of this section.)

The plastic bags were supplied to the homeowners in convenient tear-off rolls of 25 or 50. Each bag had the City of Helena seal on it and the words "Help Keep Our City Clean". The plastic bags were .5 mils thick with an M.K.C. resin additive which supposedly added 30% more strength to the bag. Bags cost 6-1/2¢ each.

After contact was made with the homeowners to explain the project, 160 homes were issued the plastic bag liners during July, 1970. After December, 1970, no more bags were issued to the homeowners because of limitations on funds.

By the end of November, 1970, all the new containers and racks were placed in the residential study area. Field observations were made to determine if any changes occurred in the efficiencies of the collection crews that could be attributed to the replacement of the old garbage cans and racks with new units. The results of these field observations are given in Table No. 5 on page 24.

As noted in Table No. 5, the haul time was reduced from 21.8 minutes to 10.4 minutes. This is because the disposal area has been relocated and

TABLE NO. 5

COLLECTION ROUTE DATA
(SPECIAL STORAGE AREA)

	Date	Haul Mileage (two ways)	Route Mileage	Haul Time Minutes	Collection Time-Min.	Time Out For Breaks	Route Collection Rate MM/Ton	Weight of Refuse Collected	Gross* Collection Rate MM/Ton
OLD LANDFILL	11/19/69	4.0	6.0	25	190	15	141	8,080	171
	2/17/70	3.7	7.0	16	200	10	125	9,570	142
	** 5/19/70	13.5	7.1	46	205	16	100	12,300	130
	Nov. thru May, 1970***			21.8	210		132	9,584	
	AVERAGE			21.8	209.5		131	9,614	
NEW LANDFILL	12/1/70	1.2	6.7	10	215	15	143	9,000	160
	2/5/71	1.3	6.3	11	138	27	157	5,475	193
	** 5/25/71	3.0	6.0	22	183	20	83	13,300	102
	9/14/71	1.4	6.5	10	170	15	118	8,650	135
	11/9/71	1.3	6.4	10	160	15	120	8,000	139
	3/13/71	1.5	6.0	10	165	15	100	9,900	115
	AVERAGE	1.4	6.3	10.4	171.8	17.8	113.9	9,054	133.8

* Gross collection rate include collection, haul and non-productive time.
**Two trips.
***Collection crew records for 37 collection days over period.

has no bearing on the installation of new storage facilities. In studying the collection time, it was noted that there was little change in the amount of collection time during the first six months after the new containers were installed. However, during the last year of observation there was a definite reduction in the amount of collection time. Actual collection time for the last 18 months of operation was 113.9 man minutes per ton, whereas during the period of observation from November, 1969, through May, 1970, the average was 131 man minutes per ton. It is felt that initially the crew was becoming accustomed to the new racks and containers and therefore, there was no initial savings in cost. However, during the latter stages there was some reduction in the amount of collection time. It should also be noted that the collection time was recorded by following and observing the crews. It is possible that the crews would tend to produce more when being observed. As previously noted in Table No. 3, page 18, the collection time during the last 18 months for all residential collection crews was 132.8 man minutes per ton. This compared favorably with the initial observations made in the study area but is approximately 20 man minutes per ton greater than the collection rate from December, 1970, to May, 1972. It should be noted that conditions may vary from one section of the City to another, which could have some bearing on the actual collection time. As noted in Table No. 5, the amount of time required for collection varies from a low of 83 man minutes per ton to a high of 157 man minutes per ton. There is no direct relation between the number of tons collected from the area and

the time of collection. This would seem entirely logical since the collection crews have the same number of containers to handle each time. When these cans are fuller, more weight would be collected in about the same time. The haul time for the study area was 10.4 minutes, whereas the average haul time for all residential collection routes was 21.3 minutes. This would, of course, vary with the location of the collection routes in relation to the disposal area.

On two different occasions, questionnaires were mailed to the homeowners in the study area to obtain their view point concerning the performance of the residential rack and can units. The results of these questionnaires are shown on the following page.

It should be noted that for both years about 91% were of the opinion that the racks and cans were excellent. In 1972 the percent of people who felt that the project helped keep the neighborhood cleaner increased from 86.5 to 96.7. It should also be noted that initially 1% indicated that their cans and lids got dented, whereas during the last year no one indicated any damage. The revised four day crew work week on the routes with the fifth day set aside for route cleanup and maintenance may account for the cleaner neighborhood and the perfect response regarding damaged cans and lids. There was an increase from 5.8% to 13.3% in those who had difficulty with their racks. The questionnaire also solicitated comments from the residents in the area. Typical comments received from the people in the area begin on page 28.

RESIDENTIAL RACK AND CAN

QUESTIONNAIRE RESULTS

			March 1971	February 1972
1.	Percent Response		59.0%	54.3%
2.	In your opinion the racks and cans are:	Excellent	91.3%	91.0%
		Fair	6.7%	8.0%
		Poor	0.0%	0.0%
		Unanswered	1.9%	1.0%
3.	Have you had any difficulty with the rack?	Yes	5.8%	13.3%
		No	91.3%	84.5%
		Unanswered	2.9%	2.2%
4.	Have the cans or rack (or both) been vandalized?	Yes	1.9%	0.0%
		No	97.0%	99.0%
		Unanswered	1.0%	1.0%
5.	Have any of the facilities (rack or cans or both) been stolen?	Yes	1.0%	0.0%
		No	97.0%	99.0%
		Unanswered	1.9%	1.0%
6.	Have dogs been able to disturb the facilities?	Yes	1.9%	3.3%
		No	97.0%	95.5%
		Unanswered	1.9%	1.2%
7.	Do the cans and lids get dented?	More	0.1%	0.0%
		Less	69.4%	84.5%
		About the same	26.9%	13.3%
		Unanswered	3.8%	2.2%
8.	Do you think this project has helped keep your neighborhood cleaner?	Yes	86.5%	96.7%
		No	7.6%	2.2%
		Unanswered	5.8%	1.1%

"Racks and garbage cans don't keep a neighborhood clean - people do - in our neighborhood some of the people consistently allow the lids to remain open. The wind still blows paper about and dogs still rip plastic bags off garbage when placed in the open.

We think these cans and racks are the best that can be had. Animals cannot get into them if they are properly closed.

This project has greatly helped our neighborhood. One neighbor still spills over his garbage - but its plain carelessness.

I had an adequate rack with four new cans which I purchased myself. The area was kept clean and the rack painted every summer and damaged cans replaced to the tune of approximately one new can each year. I don't especially appreciate having the Government furnish cans and racks at taxpayer expense. Especially when said cans and racks are obviously more expensive than what I would furnish myself. I should think that better use could be found for tax moneys.

Very good but who pays for them?

They are neat appearing and we are well satisfied.

I noticed the pick-up men take a little more care.

Sometimes the men are careless emptying the cans into the trucks and this makes a mess. This is not the fault of the cans and racks.

Children have a little trouble emptying the garbage because the rack is higher. Sanitation engineers have a tendency to put lids on too tight after emptying the garbage. Otherwise I have no valid complaints - its a great improvement!

Pick-up men are careless. Always drop 1 or 2 items under rack or in street and ignore it!

I think it is a fine project and would be worthwhile if used throughout the entire City. With all people using the same type of rack, it makes a cleaner, neater looking neighborhood and the rack you provided serves the purpose well. Thank you so very much.

These cans do the job the best of any I've ever used. No dog problems; I usually waited till I saw the garbage truck coming before I could safely put the garbage out - my can had a cover at that time too. The rack and cans are certainly the neatest looking deal I've seen. Are there any regulations

against painting the cans? The garbage service is really tops, too. They are hard workers and conscientious about their work. I have nothing but praise for the whole deal."

For the 160 homes that did not receive racks and cans, plastic bags were issued and collection was made at curb side. A separate questionnaire was mailed to these residents to determine their feelings toward the use of plastic bags. The results of this questionnaire are as follows:

RESIDENTIAL PLASTIC BAG

QUESTIONNAIRE RESULTS AS OF MARCH 2, 1971

1.	Percent Response		67.0%
2.	In your opinion the bags were:	Excellent	59.0%
		Fair	29.9%
		Poor	5.7%
		Unanswered	5.7%
3.	Do the bags stay tied?	Yes	88.70%
		Fair	1.87%
		No	4.67%
		Unanswered	4.67%
4.	Compared to cans, the bags are:	Easier to use	72.90%
		About the same	12.15%
		Harder to use	10.30%
		Unanswered	4.67%
5.	Are they hard to take out of the cans?	Yes	22.1%
		No	73.8%
		Unanswered	5.6%
6.	Were any of your bags damaged?	Tin cans	14.0%
		Dogs	49.0%
		Splitting/tearing	32.0%
		Other	10.0%
		No damage	34.0%
		Unanswered	3.0%

(continued next page)

6. (Continued)

About how many times?	Less than 10	44.8%
	More than 10	16.8%
	Unanswered	38.3%
7. What do the bags do for the appearance of your neighborhood?	Improve it	68.20%
	About the same	22.10%
	Make it worse	4.67%
	Unanswered	6.54%
8. Would you be willing to pay a minimal amount (less than 10¢) for each bag?	Yes	58.90%
	No	33.60%
	Unanswered	7.47%

9. How many bags per week do you need?

1 bag(s) - 6 responses	6 bags - 14 responses
2 " - 33 responses	7 " - 0 response
3 " - 17 responses	8 " - 1 response
4 " - 25 responses	9 " - 0 response
5 " - 3 responses	10 " - 1 response

10. Would you be willing to use the bags if they were made available to you, on a permanent basis?

Yes	86.00%
No	4.67%
Unanswered	8.41%

The majority of the homeowners using the bags thought they were easier to use than cans, they improved the appearance of the neighborhood, and damage to bags from outside sources was minimal. The collection crew indicated that the bags that were broken at curb side were caused by dogs, broken glass in the bags, or by homeowners ripping the bags when they pulled them out of their garbage cans. The crews also felt that the dog problems were caused by garbage that was accidentally spilled.

During field checks of the collection crews it was observed that crew efficiency was improved with the use of plastic bags. The pickup men previously had to carry the garbage can from the curb to the truck and return the can to the curb. However, since only approximately 160 homes in the study area received plastic bags, it is impossible to make any usable correlations between improved crew efficiencies and plastic bag usage.

About 73% of those receiving bags felt they were easier to use than cans. Sixty-eight percent felt that they improved the neighborhood. Although 86% indicated that they would use the bags if provided free of charge, only 59% were willing to pay for the bags. The questionnaire also contained a space for the individuals to make comments as to the use of bags. The following is typical of the remarks received:

"In the neighborhood I have noticed bags broken and garbage scattered and it is a mess but dogs dump over cans too - I don't have much trouble but I don't have much garbage.

Good idea, but one cannot put them out the night before because the dogs will break into them.

Yes I would be willing to use the bags if the garbage collectors would use shovels to clean up the mess of bags torn open by dogs and cats instead of ignoring the mess and leave it laying in the street.

This is a very clean, sanitary method of handling the garbage. Less problems with the damn dogs; odors cut down considerably.

Cans are better - too many dogs and tenants will not be neat about garbage.

I like this way with bags very much.

Enforce the dog leash law and the bags would be fine.

Enough ties were not provided. Picture and printing on bag is unnecessary. Time saved on collection should cover cost of bags.

I think people clean a little more because these bags are really handy and easy to use and pack around, and are always available.

Please let us know when we can purchase more.

Much better system of garbage collection; easier for a woman to handle than cans; appreciate bags very much.

We provide garbage cans and feel they should be used - too many dogs in this neighborhood running loose.

The garbage is lighter than the can so it is easier to carry out to the curb. Don't have to watch and bring empty can back.

More closure ties are needed with the bags. I would like to see everyone use them.

I am an old lady over 80 years and the bags are much easier than cans, and I don't worry about them blowing away on a windy day, like garbage cans do. Hope you keep the bags going. Thank you.

We are willing to use the sacks if they stay within a reasonable price.

Plastic bags improved our surroundings a lot."

Since the use of plastic bags received general acceptance, a more detailed evaluation of the effect of plastic bags on the cost of collection was made in another area where bags were issued to each individual homeowner. In the initial study the bags were only placed at those houses where curb-side collection was required and where racks could not be properly installed.

In the Sun-Haven Addition, a relatively new housing development in Helena, a total of 96 residences were used for a special study during April and May of 1971. On eight occasions the City measured the time it was taking to collect refuse. The area at that time had curb-side collection - the

standard 32 gallon metal cans. The following year the City issued plastic bags to each of the residents and discussed the project with them. During April and May of 1972, on eight different occasions the City again measured the time it took to collect from the same residents. The average time required to collect from the 96 residences when they had cans was 42 minutes. When plastic bags were used, it took 21.6 minutes. Therefore, there was a savings of almost 50% of the actual collection run. Although this was not an extensive study and the amount of savings may vary from one area to another depending upon the individual condition, it is concluded that substantial savings can definitely be realized by going to collection by plastic bags.

CONCLUSION OF THE STUDY AREA

The racks and cans had little overall effect on the efficiency of collection. Toward the latter phases of the study when the collection crews were accustomed to the new equipment, there was a small increase in efficiency of collection. The storage equipment proved to be durable and to hold up well. The project was accepted by the public and the overall esthetics of the neighborhood was improved. A collection crew appeared to respond to the interest that had been generated by the project. They seemed to be doing a better job at the end of the project than they were initially doing. The second questionnaire showed there was greater satisfaction with the collection crews. Initiation of the four day work week for refuse collection with the fifth day for route maintenance seemed to contribute to less damage to cans, less spillage, and a better overall job of collection.

RESIDENTIAL RACK AND CONTAINER STUDY AREA

Residential storage area prior to study

Residential rack and can placement at same location

Residential storage area prior to study

Residential rack and can placement at same location

RESIDENTIAL PLASTIC BAG USAGE

Curb-side placement of plastic bag containers

Curb-side placement of plastic bag container

Plastic bag container torn open by dog

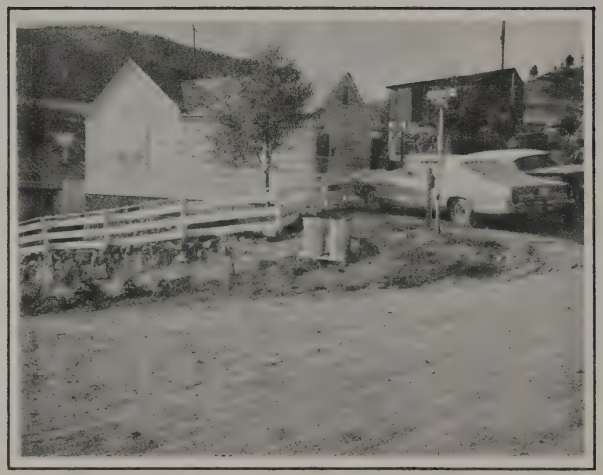
Curb-side placement of container prior to study

RESIDENTIAL STUDY ROUTE AREA TYPICAL TERRAIN

Dead end alley

Short hill, looking up

Long hill, looking up



Long hill to left

SECTION V - COMMERCIAL STORAGE

PURPOSE

The purpose of this portion of the project was to reduce the collection cost and improve the sanitary and environmental conditions through the placing of bulk storage containers and the reorganization of collection routes. Prior to this project there were no bulk containers. There were two collection routes which generally collected in the commercial area. However, they were intermingled with residential collection. This project purchased and placed bulk containers and reorganized the collection routes to provide a more efficient operation.

DESCRIPTION OF COMMERCIAL AREA

The central business district is located in Last Chance Gulch. Street slopes vary from about 3% to as high as 15% on each side of the Gulch. Much of the area does not have alleys. In some cases, pickup must be made on heavily traveled streets within the central business district. Merchants often place their refuse on the sidewalks at closing time. The collections are made between 5 P.M. and midnight. The general limits of the downtown commercial area are outlined on the location map in the appendix of this report.

METHODS USED TO EVALUATE COMMERCIAL STORAGE SITES

Prior to this project the City operated two routes which made commercial collections. One crew worked the night route from 5 P.M. until about midnight. The other crew worked from 3:30 P.M. until late in the evening.

These crews made collections within the central business district and other commercial areas including schools and public facilities throughout the City. A few residences located in the commercial area were also served.

The efficiency of these crews was checked prior to making any changes in the operation. Field observations were made on the crews during the fall, winter, and spring of 1969 and 1970.

Detailed data was kept for all operations for each collection route. For each commercial storage site, stop watch timings were recorded from the time the collectors stepped off the truck to pick up the refuse until they stepped back on the truck. The number of 32 or 55 gallon containers emptied and the number of hand loads was also recorded. This data was used in selecting those commercial sites to receive bulk containers.

It takes the crews a minimum of one minute to collect a two cubic yard bulk container from the time the truck stops at the site until it leaves the site. A field timing on a Leach packer unit with a one cubic yard hopper revealed that the unit was capable of lifting, emptying, and lowering a two cubic yard bulk container in 30 seconds. However, the bulk container had to be lifted twice to empty two cubic yards of waste since the packer hopper would only hold one cubic yard. Different packer units have different packing rates and hopper sizes, but the one minute limit proved satisfactory for the equipment used in Helena.

As a result, one criteria for a bulk container site was that it required more than one minute to collect the existing 32 or 55 gallon containers. The

sanitation and the esthetics of the storage sites was also considered in selecting sites to receive bulk containers. (See photos at end of section.) It was impossible to place bulk containers at some sites because of the limited space.

PROJECT INFORMATION COLLECTED

A total of 68 city owned bulk containers were placed between July 1970 and December of 1970. Field measurements were made at about 55 commercial bulk container sites to record the actual time of pickup prior to installing bulk containers and after the bulk containers were installed. The sites receiving the bulk containers were those sites selected from the previous field observation and evaluation as noted above. Those sites which required more than one minute for pickup were given a bulk container. The average time per site without bulk containers was 2 minutes and 33 seconds, while the average time after placing bulk containers was 1 minute and 42 seconds. Thic could indicate a reduction in time of approximately 33%. Several time measurements were made after placing the bulk containers. However, the initial measurement is felt to be the most reliable because of the changes in many of the businesses being served. Some moved or went out of business while others required more containers because of an increased volume of refuse.

Beginning in December, 1970, the recordkeeping for the entire system was expanded so that the data was collected separately for residential, commercial, and bulk collection. Although this change was after the bulk

containers were installed, it does give a detailed cost for the collection routes during the last 18 months of this project.

EVALUATION OF INFORMATION COLLECTED

Table No. 3 in Section III summarized the collection operation records for all forms of refuse including residential, commercial, and bulky. This data is separated into that collected prior to and after the change in the format for recordkeeping. Table No. 3 indicates an overall decrease in the total collection cost. (All forms of refuse decreased from $15.56 prior to December, 1970, to $14.12 after 1970.) Prior to December, 1970, separate records were not kept on the actual cost of commercial collection other than the special studies to determine which sites needed bulk containers, as discussed previously in this report. In evaluating the cost of commercial collection in relation to the residential and bulky, it is noted that the commercial costs $11.42 per ton for collection and haul compared with $13.67 for residential and $21.68 for bulky wastes. This lower cost can generally be attributed to the greater weight of refuse per site collected. However, a more detailed evaluation of the various elements of the commercial collection follows.

There were three different elements during the course of this project that improved the efficiency of the commercial collection:

1. Installation of bulk containers.
2. The reorganization of the commercial collection routes.
3. Placing into operation a new 20 yard packer truck in place of the old 16 cubic yard unit.

The placing of 68 bulk containers on the commercial collection reduced the pickup time at the site by 33% as discussed under data collected. In evaluating data collected in the field, it becomes apparent why there would be a savings in pickup time because there was a substantial reduction in the number of containers handled, the number of hand loads required, and the number of sites that required over one minute to load. The reorganization of combining all commercial collections in one route rather than the two routes also had a very beneficial effect. The initial operations with two routes included many residential services intermingled with the commercial collection. The 20 yard packer had a larger hopper which aided in the pickup time at each site where there was a bulk container. The increased capacity also reduced the haul time to the disposal site.

Field data results indicate the amount of refuse collected varied as much as 45%. This is because different businesses are served each day.

It is felt that a portion of what was once collected as bulky waste is now included in the bulk containers and has become part of the commercial collection. The total volume of bulky waste collected as shown on Table No. 1 decreased by 24%. Records at the landfill indicated that the weight of commercial refuse collected decreased over the two periods by 15%. The elimination of residences from the commercial routes was a big factor in reducing the amount of commercial refuse received at the landfill. During the first period of records, no separate data was kept on demolition wastes. Due to the urban renewal projects in progress, this waste became a sub-

stantial volume of the total wastes in the latter period of this project. Demolition wastes were then entered as a separate item. This would indicate why both the commercial and bulky waste collection items were reduced.

PUBLIC ACCEPTANCE AND ENVIRONMENTAL CONSIDERATIONS

The esthetics and sanitation of the storage sites has improved due to the placement of bulk containers. At the end of this section are "before" and "after" pictures of the storage sites which best illustrate how the overall site conditions were improved. Dumped over garbage cans, loss of garbage can lids, spilled waste and unsitely messes have to a large extent been eliminated. However, to better evaluate the project, a questionnaire was sent to the merchants and shop owners to get their reaction to the bulk containers. The results of this questionnaire are shown on the following page.

Following are typical comments from the businessmen being served.

"We are very well pleased with our container. The only thing is we will probably have to have another one in the near future.

We were burning before and were able to keep a clean place. Now we have too much garbage for our container.

Having used these containers at some school buildings we have found the only drawback is that the students will on occasion roll the container away from its assigned space.

The containers we have are always full and we wish we had two more or more frequent pick ups. We have 58 tenants using the two containers we have. Other than this, we think they are great.

Container works very well for loose bottles, waste paper, etc. But we have had some difficulty as before with large boxes, too large or too numerous for the container.

I think this container is the start of the right garbage container.

BULK CONTAINER

QUESTIONNAIRE RESULTS

	5/10/71	11/30/72	5/31/72*
1. In your opinion, the bulk containers are:	Excellent 86% Fair 11.1% Poor 0% Unanswered 2.9%	Excellent 81% Fair 19% Poor 0% Unanswered	Excellent 91% Fair 9% Poor 0% Unanswered 0%
2. Have you had any difficulty with the container?	Yes 14.8% No 81.5% Unanswered 3.7%	Yes 28% No 69% Unanswered 3%	Yes 19.0% No 81.0% Unanswered 0%
3. Has the container been damaged?	Yes 21.2% No 78.0% Unanswered 0%	Yes 28% No 69% Unanswered 3%	Yes 35.5% No 64.5% Unanswered 0%
4. Has the container helped you in keeping your premises cleaner?	Yes 96.3% No 3.7% Unanswered 0%	Yes 94% No 6% Unanswered 0%	Yes 94.0% No 6.0% Unanswered 0%

*Percent Response: 100% of 31 questionnaires were answered.

We like this program and would like to see it continued.

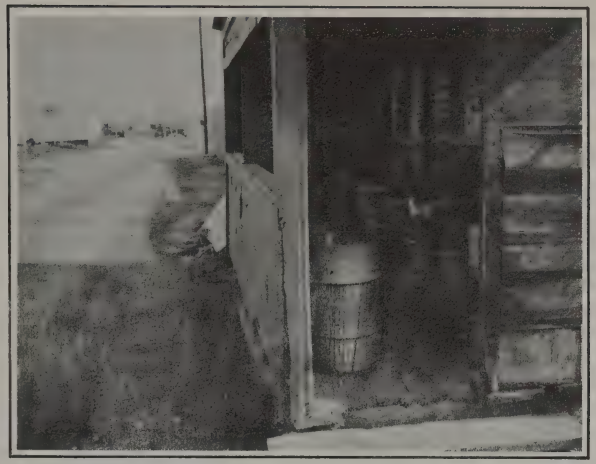
Lids are being damaged by the handlers.

The service has been very, very good.

We need two containers at least.

Moderate damage to lids."

COMMERCIAL STUDY AREA (BULK CONTAINERS)



Commercial storage area prior to study

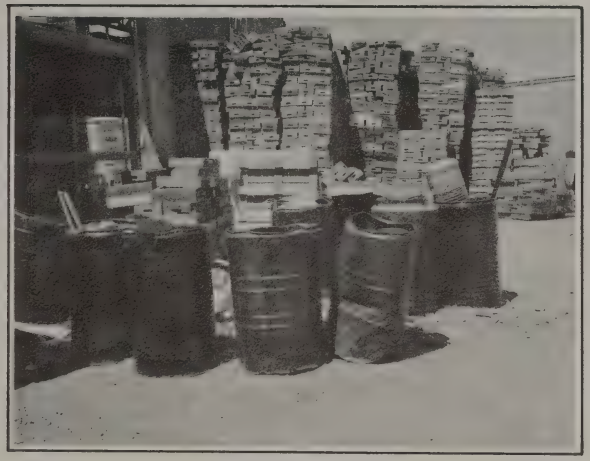
Bulk container placement at same location

Commercial storage area prior to study

Bulk container placement at same location

Commercial storage area prior to study

Bulk container placement at same location



Commercial storage area prior to study

Bulk container placement at same location

SECTION VI - DISPOSAL FACILITIES

PURPOSE

This project included the development of a sanitary landfill at a location centrally located within the City of Helena. During the initial phases, the existing landfill disposal facility was monitored to establish operational costs and to determine the cost of hauling collected refuse to this site. It was then possible to make a comparison between the cost of operating the existing site and the cost of operating the new sanitary landfill. The operation of the new landfill in a developed area within the City made it absolutely necessary to maintain rigid standards of operation and strict control of all phases of the landfill operation.

The project had a secondary purpose of providing land reclamation. The new landfill site had little value for any type of development. It was in a low area, ponding water, and subject to flooding. By providing drainage improvements and filling the drainage channel with the refuse, it is possible for the City to ultimately develop the entire area for recreational purposes.

A copy of Form #10 (Collection Facility Inventory) indicating costs, depreciation, and the economic life of the landfill facilities is shown in the appendix.

DESCRIPTION OF LANDFILL

The landfill disposal site used by the City of Helena until October of 1970 was located approximately 2-1/2 miles northeast of the City Center. An old gravel pit was being used for bulky items and rubbish, and the

surrounding area was used for disposal of garbage and other wastes. The trench method of disposal was used for burying the refuse. This landfill received refuse from both the City of Helena and from developed areas adjacent to the City. There was no charge for disposing of refuse at the site for either residents of Helena or those residing in the outlying areas. No burning of any type was allowed at the sanitary landfill. The site was kept open from 7 A.M. until 7 P.M. After hours the fenced area was locked. This presented a problem in operation in that refuse was often dumped in front of the gate, requiring clean-up each morning.

The refuse disposed at the old landfill site consisted primarily of residential, commercial, and bulky wastes. The amounts of industrial wastes for this area were considered negligible. Prior to this project, the City of Helena estimated that 10 or 20% of the total wastes brought to the landfill came from residents outside the city limits of Helena. The other refuse was either hauled by City collection vehicles or by the homeowners living within the City limits. Daily cover was accomplished with a crawler tractor with a dozer blade and tractor-drawn scraper. A front-end loader from the Street Department was used as needed to assist in digging trenches.

The new sanitary landfill site is located approximately 1/2 mile north of the central business district. This landfill has been in operation since October of 1970. (See photos at the end of section and location map.) This site was selected because of location and the opportunity of reclaiming the land. The old landfill site was phased out except for bulky waste items

when the new landfill was placed into operation. Lewis and Clark County has opened another site to serve rural people who were using the City's old site.

The new disposal site contains 18.8 acres. The site has major arterial streets on the east and south and railroad tracks on the north and west. The area immediately adjacent to the site on the east was used for recreational purposes with baseball fields already established. Immediately east of the Last Chance Gulch arterial street is a swimming pool, ball park, and other recreation facilities. West of the tracks on the west of the site is located the City Shop and the area to the northwest between Benton Avenue and the railroad tracks is the campus of Carroll College. This is relatively high ground which overlooks the disposal site.

For many years prior to this project, the site had been used to dispose of fill dirt and construction rubble. Test holes were dug throughout the location to determine the character and extent of material that could be used for cover soil. The soil consisted mostly of clay and silt with a small amount of gravel. This material has proven adequate for cover soil.

The low portion of the site is a drainage channel for the Last Chance Gulch. Prior to beginning landfill operations, a 66 inch diameter reinforced concrete pipe was installed to carry drainage through the site. The construction of this pipe included the placing of a clay seal over the top of the pipe to prevent water from infiltrating from the landfill wastes into the pipe. (See photos at the end of this section.)

A 30 ton capacity truck scale with scalehouse was constructed prior to operating in the area. The scalehouse included bathroom facilities and a small amount of storage area for small tools and equipment.

The trench method of landfilling is being used with the operation beginning at the north end of the site which had a considerable amount of previously deposited fill material. Prevailing winds caused some problems with the first trench orientation. Winds in the vicinity of 40 to 50 miles an hour are not uncommon in this area. By reorienting the trench perpendicular to the prevailing winds the problem has been held to a minimum. Portable fence units are utilized to control blowing paper. These units are placed side by side to provide a 10 foot high fence along the trench. (See photos at the end of this section.) An additional snow fence encloses the entire area to trap blowing debris. During periods of wind of 50 miles an hour or higher, some papers soar over the fences and blow into adjacent areas.

Prior to March of 1971, equipment used at the landfill site included a D-7 crawler tractor equipped with a dozer blade and cable scraper. A 72-40 Euclid front-end loader, equipped with a 3 yard 4 in 1 bucket, with fortified tires was used to place and compact earth cover. The Euclid was a 1962 model purchased for $25,000 by the City in 1968.

Beginning in March, 1971, a new W-26 Case loader was placed into operation. It was purchased for $38,000, has a 5 year economic life, and an annual depreciation of $7,600. This loader was equipped with a 4 in 1 bucket and iron compactor wheels (Cepeco Wheels). Upon placing this piece

of equipment into operation, the D-7 crawler tractor and cable scraper and the 72-40 Euclid front-end loader were taken out of operation. However during periods when new trenches are being excavated, the D-7 crawler tractor is used to assist in the excavation at that time. (See photos at the end of this section.)

After placing the new landfill into operation, those people residing outside the City of Helena were charged for disposing of refuse at the site according to the following schedule:

Car Load	$0.50
Pickup Load	$1.00
Trucks over 1 ton	$2.00
Commercial Rate	$2.50 per ton

The landfill is open from 9 A.M. to 6 P.M. Monday through Saturday and is closed Sunday during the winter. Summer hours are 9 A.M. to 6 P.M. seven days a week.

Initially a bulk container was placed outside the gate for after hour deposit. The use of this bulk container proved unsatisfactory to the City of Helena. The people coming to the site after hours abused the container by placing large bulky items such as motor blocks into the container which dented and damaged it. Many people didn't bother to use the container but simply dumped the refuse on the ground. The City found that by having no container, there was less refuse littering the area. Each morning if there has been any refuse deposited, the operator picks this refuse up with his front-end loader and buries it during his initial operation.

The type of material deposited at the new site compares with that of the old site with one exception. Helena has an urban renewal project which sends demolition debris to the new landfill site. This material has been separated from the other categories which have been weighed separately since December of 1970. Dead animals are not handled at the landfill site but are disposed of by the Helena Animal Shelter.

EVALUATION OF DATA COLLECTED

At the beginning of this project, a small portable scale was used in September of 1969 to weigh refuse at the old landfill site. This scale proved inadequate and time consuming in operation. During November of 1969 a platform scale and scalehouse were rented and installed at the old landfill site. Since then the weight of all refuse being received at both the old and new landfill site has been recorded. Beginning in December of 1970 the recordkeeping procedure was changed to extend the categories on which statistics were being kept. The quantities of solid waste received at the landfill are shown on Table No. 1. This table has been separated in accordance with changes in recordkeeping procedures. Recordkeeping changes of December, 1970, correspond closely to the initiation of the new landfill operation on October 1, 1970. As discussed in Section VII, additional cost accounting data was maintained throughout this project. The following table summarizes the results of the operating cost during this project.

TABLE NO. 6
OPERATION RECORDS - DISPOSAL
AVERAGE DISPOSAL COSTS PER MONTH

	Nov. 1969 thru Nov. 1970	Dec. 1970 thru May 1972
Disposal Operation Cost/ Ton	$1.64	$1.18
Disposal Repair & Maintenance Cost/Ton	0.37	0.17
Depreciation Cost/Ton	0.33	0.49
Total Disposal Cost/Ton*	$2.34	$1.84
Tons Disposed**	1,769.8/month	1,648.5/month
Demolition Tons Disposed	Negligible	1,981.2/month

* Demolition waste excluded
** Excludes demolition

The table has been divided to include the costs for the period of time when the record changing took place. However, it is felt that these records closely illustrate the change in cost between the old and the new landfill operation.

The table above gives the breakdown of cost per ton for operation (labor), repair and maintenance, and depreciation. It indicates that there was a decided reduction in the cost of operation after December of 1971, both in operating cost and repair and maintenance costs. The operating costs (labor) decreased by 28%, and the repair and maintenance costs decreased by 54%. We feel that this reduction in cost is attributable more to new equipment than to the change of the landfill. Excavating may be somewhat easier in the new site because much of the cover material is previously deposited fill material. We do not feel this is a major factor. The new landfill site does have some

rubble such as concrete slabs and curbing that interfere with the excavation operation. As previously mentioned, a new W-26 Case loader replaced the 72-40 Euclid front-end loader in March of 1970. This new piece of equipment has proven more efficient for the City's operation, and the repairs and maintenance were much less. This savings is offset by the increased depreciation costs. However, the new equipment contributed to a savings in labor costs. The labor required for operation of the landfill consists of two attendants to weigh the refuse and one equipment operator. The equipment operator works an eight hour shift per day. One of the two attendants is on duty at all times during the day when the landfill is open.

During periods that a new trench is being opened, a second operator is required to operate the D-7 crawler tractor. This piece of equipment is used by the Street Department during periods when it is not needed at the landfill site. To further substantiate the cost of operation, the monthly records were analyzed the last 12 months, June of 1971 through May of 1972. The operating cost for this period was $1.09 per ton and repair and maintenance was $0.14 per ton based on 43,834 tons of waste. Operating costs will probably increase as the equipment becomes worn and less efficient.

The salary of the heavy equipment operator at the landfill was increased from $550.00 to $575.00 per month from 1970-71 to 1971-72. Scale attendants received wage increases from $450.00 to $485.00 per month for the same period.

The new landfill site is 2 miles closer to the downtown area of Helena than the old site. When the new landfill was put into operation, collection

routes were changed to better utilize the new location. The average cost per ton for haul at the old landfill site was $4.12. At the new landfill, the cost per ton dropped to $3.43 which is a decrease of about 17%.

It should be noted that the compactor wheels on the Case loader worked well on normal refuse. However, the machine did not operate as well on demolition wastes. This waste is being processed by the use of the D-7 crawler tractor. Since this material comes in periodically, the crawler tractor can be brought in only when needed to handle the demolition material.

Although not part of the original project, tests were conducted to determine the amount of compaction that was being obtained on the refuse. The first test was run during June of 1971. This test area contained 45,000 cu. ft. in which 470 tons of refuse were deposited. The amount of cover material contained in this area was estimated to be 20% of the total volume which left a net volume of 36,000 cu. ft. The density on this basis was computed to be 702 pounds per cu. yd. Another test was conducted during March of 1972. A test area with a volume of 141,600 cu. ft. and a cover material allowance of 20% resulted in a net volume of refuse equal to 113,280 cu. ft. A total of 1,899 tons were deposited within this test area giving a density on the refuse of 902 pounds per cu. yd. It is felt that the latter result is more accurate because it was a much larger volume that was tested. Both areas were compacted with the W-26 Case loader with Cepeco compactor wheels. The loader is covering and compacting the refuse for about 5 hours per day. The remaining 3 hours per day is spent obtaining cover material.

LANDFILL LEACHING

A report concerning the possibility of ground water pollution from leaching at the landfill was prepared by Dave Thomas, Sanitarian for the Helena-Lewis and Clark, City-County Health Department, and is included verbatim below.

Statement of Problem

During September, 1970, the City of Helena transferred its landfill disposal operation to a site near the central business district of the City. The location is an old rubble dump and lies in the drainage of Last Chance Gulch. The City of Helena also uses a portion of the site for disposition of snow removal from City streets. For these reasons and because the vicinity has been extensively placer-mined, questions have been asked concerning the possibility of ground water contamination by leaching of the landfill.

In addition, residences outside the City limits use individual water supply systems that tap ground water supplies approximately two or more miles downstream from the landfill and placer-mined tailings.

Leachate

Leachate, water emanating from solid waste, carries organic and mineral wastes (dissolved or suspended) with it. The source of this water may be ground water or infiltrating surface water or a combination thereof. Leachate may appear at ground surface, as a spring, or percolate through the soil and rock formation underneath and around the fill.

In the Helena landfill, storm run-off and natural drainage (as well as low areas of ponding) have been carried through the fill area by means of a 66 inch diameter reinforced concrete pipe. This installation included a clay seal over the top of the pipe to avoid infiltration of water. This precaution will insure that no leachate from the fill area will contaminate surface waters in the Last Chance Gulch drainage.

In terms of the Helena site then it can be said that any leaching which occurs will percolate into surrounding soil and rock formations. This leachate is subject to purification in several ways: ion exchange, filtration, absorption, precipitation or biodegradation. These attenuation mechanisms are dependent upon soil properties, permeability, and degree of saturation.

The area of the Helena landfill is underlain by alluvium and alluvial fan deposits that rest in a shallow valley cut into Tertiary lake-bed deposits. The alluvium and fan deposits are composed of silt, sand, gravel, and cobbles. Both these deposits have been thoroughly placer-mined, with the net result being to sort the material according to grain size - in places the material consists almost entirely of gravel, in others sand, and in still others mostly silt. However, north of the railroad tracks, dredging operations resulted in more uniform reworking of the sand and gravel, making the area comparable to a gravel pit.[1]

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[1] Written correspondence. Mr. Don Coffin, U.S. Geological Survey, Water Resources Division, June 16, 1971.

Because of the type of material in the area, and the evidence of ponding just north of the tracks, the flow of water may be described as saturated. The direction of flow of leachate in the saturated zone is primarily controlled by the hydraulic gradient.[2] Therefore, leachate travel closely follows the streamlines of ground-water flow. Ground-water flow in the landfill area is confined primarily to the placer material beneath Last Chance Gulch. The underlying "lake-bed" deposits seem to be of relatively low permeability and serve to keep water in the alluvium from flowing downward into deeper horizons. Water in the placer material flows northward and probably some of it makes its way to the dredging piles. The water probably tends to flow through the placer material in irregular paths formed by randomly connected permeable zones of well-sorted, coarse-grained material. Water in the dredging piles moves northward from the dredgings into the alluvial fan deposits. Water in the alluvial fan deposits may eventually flow into Ten Mile Creek. In places along Last Chance Gulch and in the dredging piles where the water table is close to land surface, ground water is evaporated and transpired from the soil, ponds, and marshes.[3]

Information on the travel of leachate in the saturated zone has been investigated to a limited extent, but more research is needed to clearly define the problem. Results so far indicate that travel depends on soil properties

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[2] Brunner, Dirk R.; Keller, Daniel J.; Reid, Jr., Chas. W.; Wheeler, John; Sanitary Landfill Guidelines, 1970 E.P.A., Office of Solid Waste Management Document, Pages 1-11.

[3] Written correspondence. Mr. Don Coffin, U.S. Geological Survey, Water Resources Division, June 16, 1971.

and type of contaminant. Biodegradeable organic materials do not travel far (3-7' in soil, up to 200' in gravel)[4], but inorganic materials have been traced through glacial alluvium 1,200 feet from a fill located in an abandoned gravel pit.[5]

The quality of leachate is improved by attenuation of contaminants as it travels through saturated soil. Inorganic materials (as evidenced above) appear most resistant to attenuation. Chloride ion is particularly resistant and therefore serves as a good indicator of leachate movement. At the Helena disposal site, a portion of the area is used for snow removal dump. This area, comprising about 20,000 sq. ft. in a level portion of the old rubble dump, lies directly north of Lyndale Avenue on the southernmost edge of the disposal site. The City uses sand and rock sale (NaCl) in combination during the winter months for traffic safety on icy and snowy streets and annually deposits about 6,000 tons of this material during street cleaning operations. Additionally, the State Highway Department probably contributes a like amount of snow from removal operations, but the composition of the material is not known. This material probably contains a high concentration of cl-ion and would (as a result of melting) contribute to the overall chloride load in any leachate that appeared. Data from monitoring wells

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[4] Classroom Instruction. 1969 D. Dunn. Ground-water M.S.U. Bozeman, Montana.

[5] Brunner, Dirk R.; Keller, Daniel J.; Reid, Jr., Chas. W.; Wheeler, John; Sanitary Landfill Guidelines, 1970 E.P.A., Office of Solid Waste Management Document, Pages 1-11.

surrounding a landfill would indicate a sharp increase in chlorides and total dissolved solids when leachate appeared.

Anderson and Dornbust[6] have found that chloride, sodium, specific conductance and total and calcium hardness were the inorganic parameters of ground water quality which could be used most effectively to denote any changes attributable to leachates from the disposal area.

In the summer of 1971, the U.S.G.S. undertook a ground water monitoring program in the Helena Valley. Domestic wells surrounding the landfill and mine wastes were incorporated into this project as money was not available through the Solid Waste Project to develop these wells near the landfill. The use of data from these domestic wells will provide useful monitoring of ground water quality as affected by leachate from the disposal site.

Location	Specific Conductance (umhos/cm @ 25°C)	Cl (mg/l)	NO_2+NO_3 as N (mg/l)	Diss. Solids (mg/l)	Approximate Distance from Landfill
1. 700 Cole	568	27	0.11	341	2640 feet
2. 431 Custer	1060	51	1.4	643	1 mile
3. 3108 McHugh	649	16	0.42	389	1 mile
4. 1016 Custer	618	18	0.56	365	1-1/4 mile
5. 4295 McHugh	446	8.5	0.16	268	1-1/2 mile
6. Rasmussen	605	21	0.67	360	1-3/4 mile
7. 3736 N. Mont. Ave.	636	24	6.3	382	1-3/4 mile
8. 3653 McHugh	528	11	0.59	316	2 miles
9. 1040 Middlemas	708	26	1.9	425	2-1/4 miles
10. 3980 McHugh	708	25	1.3	425	2-1/2 miles
11. 4322 N. Mont. Ave.	507	10	0.65	304	2-3/4 miles

[6] Zanoi, A.E. 1972. Ground-water Pollution and Sanitary Landfills - A Critical Review. Ground-water, Volume 10, Number 1, Pages 3-12.

1962 U.S. P.H.S. Drinking Water Standards (in part):

Chemical Characteristics

5.21 The following chemical substances should not be present in a water supply in excess of the listed concentrations where, in the judgment of the Reporting Authority and the Certifying Authority, other more suitable supplies are or can be made available.

Substance	Concentration in mg/l
Chloride (Cl)	250.
Nitrate (NO_3)	45.
Total Dissolved Solids	500.

Conclusions

From the preceding table, some conclusions can be drawn:

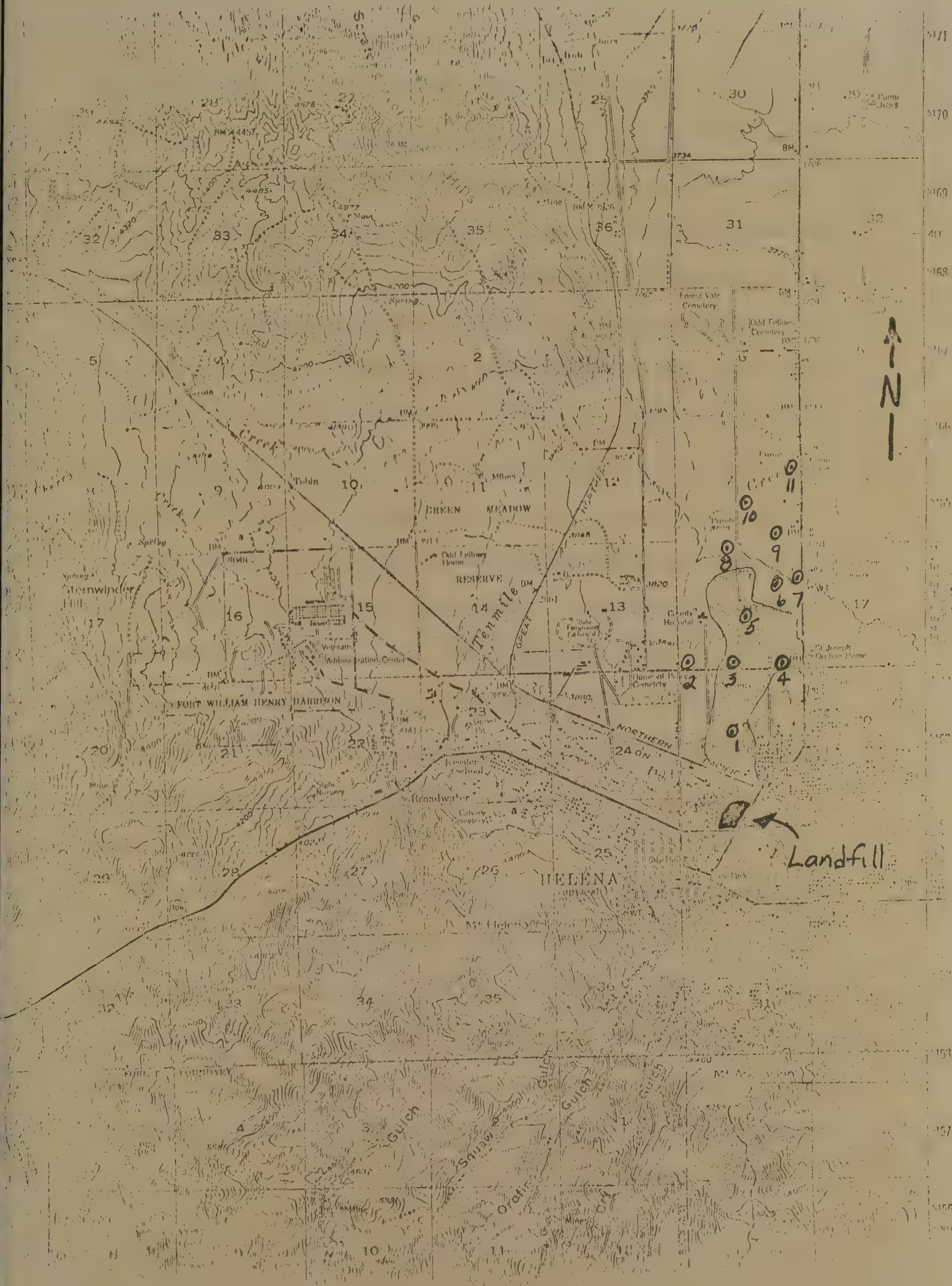
1. All results are well within the minimum acceptable standards prescribed by 1962 U.S. Public Health Service Drinking Water Standards for domestic water supplies.
2. Chlorine and nitrate values are comparable to results found in the Helena Valley outside of the sphere of influence of any landfill leachate.
3. The use of the landfill site for snow removal activities does not appear to have a detrimental effect on ground water quality.

4. No ground water reservoir samples taken were contaminated by landfill leachate.

5. The aforementioned wells should be chemically analyzed routinely over the next ten to fifteen years in order to determine when and if contamination occurs.

6. It is suggested that wells be installed and periodically monitored near the site to test for future contamination.

See location map on following page.



N
Landfill
GREEN MEADOW
RESERVE
FORT WILLIAM HENRY HARRISON
HELENA
Sternwinder Hill
Forest Vale Cemetery
Odd Fellows Cemetery
Odd Fellows Home
Tenmile
Creek
NORTHERN
Broadwater
County Hospital
Tobin
Spring
1
2
3
4
5
6
7
8
9
10
11

HEALTH ESTHETIC CONDITIONS AND PUBLIC ACCEPTANCE

The landfill site has certain problems that are inherent of all sanitary landfills. During periods of high winds there are some papers that are blown out of the site. Fencing and other controls to prevent blowing paper are fairly effective but are not perfect. The direction of prevailing winds is such that papers are blown into the existing City park development, a railroad track, and an industrial area. The landfill has been developed to divert surface runoff away from the disposal areas. Improvements include a drainage pipe to carry runoff down the channel that is being filled. Precautions have been taken to prevent water from leaching through the fill into the drainage channel. The City has had no problem with rodents and limited problems with flies and other vectors. Because of the location of the site with relation to prevailing winds, there have been no complaints or adverse public reaction to the landfill being in this location. The City has made every effort to control their operation in a more rigid manner than most landfills throughout the State of Montana.

FUTURE USE

The landfill site has been designed to bring the final grade to proper elevation for future development as a park. Allowances have been made for settlement within the refuse, and compaction of the refuse has been accomplished to reduce the amount of settlement. The site will be ultimately developed as a large recreation park and complex to be operated by the City of Helena. The YMCA has recently started construction on an undisturbed

portion of the site which will not receive any fill material. Recreational facilities included in the building are an indoor swimming pool, gymnasium, and handball courts.

The original projection was that the landfill site would last for 10 years. However, the large volumes of demolition debris that are being disposed of in the site will reduce the life expectancy. The City is investigating the possibility of obtaining additional land adjacent to the present landfill, on the immediate north, to provide additional area for operation.

Concrete pipe drain installed through landfill site

Completed clay seal over drain pipe at landfill

New scalehouse and restroom facility at landfill

Portable fence units for controlling blowing papers at new landfill operation

Looking west from northeast corner of new landfill site

Looking north along centerline of new landfill site

Looking west from northeast corner of new landfill with fill operation in process

Looking west from northeast corner of new landfill with cover soil over one lift of compacted refuse

W-26 Case front end loader, 4 in 1 bucket and iron compactor wheels

W-26 Case loader on completed lift at backfill

D-7 Caterpillar - standby usage

SECTION VII - PROJECT COST ACCOUNTING

PURPOSE

A detailed system of recordkeeping was initiated to provide data and information necessary to evaluate the City's solid waste operation.

The cost accounting system was initiated at the beginning of the project in June of 1969 to provide an economic evaluation of changes in operation. The system is in accordance with guidelines proposed by the U.S. Environmental Protection Agency. A series of reports by Mr. Eric R. Zausner give more detailed information on accounting systems for the various phases of solid waste management. The accounting system was expanded in December of 1970 to provide additional information. There were eleven different forms used and a sample of each is shown in the appendix of this report. Data taken from these forms has been discussed in the previous sections.

DESCRIPTION OF FORMS

The forms used are self explanatory for the most part. Form #1, "Weekly Labor Ticket", is completed daily by the Sanitation Department Superintendent, Mr. Don Lewis, and indicates the total hours worked by each employee.

Form #2, "Daily Truck Weight Record", is completed daily by the scale operator at the landfill site. This record is an indication of the type of refuse brought to the landfill and whether it is a city vehicle or other type. At the bottom of this sheet is recorded the total hours per day that the landfill equipment is in use.

Form #3 is completed by the driver of each collection vehicle. At the top of this form is recorded the time and truck mileage when the truck leaves the shop in the morning and returns in the afternoon. The time start and time finish at the bottom of the form is recorded when the actual collection phase of the route is started and ended. This is an indication of the actual time spent collecting refuse.

Form #4, "Complaint Notice", is completed by the Superintendent when he receives a legitimate complaint from a homeowner.

Form #5, "Daily Repair and Maintenance Record", is completed daily by the maintenance department for all sanitation vehicles. This provides a record of all vehicle maintenance and repair costs.

Form #6, "Crew Performance Evaluation", is completed weekly using data collected daily on forms #1, #2, and #3. The Superintendent completes this form.

Form #7, "Operating Cost Summary", has been expanded over that used at the beginning of this project. This form is a cost summary sheet completed monthly by the Superintendent. It is very detailed and uses data from forms #1, #2, #3, #5, #6, and #8. A detailed explanation of this form and a form indicating average figures are shown later in this report. During the last year of the project, notations were made on this form for the weight of refuse from collection crews, private haulers, and demolition wastes.

Form #8, "Monthly Vehicle Performance Evaluation", is completed monthly by the Superintendent of the Department of Sanitation. Data collected includes

the individual and total costs of operation and maintenance for all the department vehicles.

The City Accounting Department completes Forms #9 and #10 on equipment and facility inventory. Depreciation of equipment and facilities is indicated on these forms.

The annual "Total Collection Cost Summary", Form #11, is completed by the Accounting Department at the end of each three month period. Total operating and depreciation costs are computed on this form.

DESCRIPTION OF MONTHLY OPERATING COST SUMMARY FORM

An outline explanation is given below of the steps required to complete Form #7. A copy of Form #7 is shown with Roman numerals after each item listed. The Roman numerals indicate the section in the outline explanation describing the procedure used to compute that figure.

On Form #7 the Route Service Cost Center pertains to those costs directly related to the actual collection phase of the routes when the crews empty the refuse containers. The Hauling Cost Center deals with the costs of hauling the refuse from the routes to the landfill. Nonproductive time, such as coffee breaks, are included in the haul time in this report. The Repairs and Maintenance Cost Center are for the collection vehicles only (excludes disposal equipment). Each cost center is broken down further into Residential, Commercial, and Bulky Waste Sections.

Disposal or landfill operations are separated into the Disposal Cost Center and the Repairs and Maintenance Cost Center. All repair and

maintenance costs on disposal equipment are included here under Disposal Operations to keep them separate from the Collection and Haul Operations. Collection and Haul Totals are kept separate from the Disposal Totals.

The outline for the monthly operating cost summary is given on the following pages.

MONTHLY OPERATING COST SUMMARY*

Collection & Haul Operations	Factor	Residential $ or Amount	Commercial $ or Amount	Bulky Waste $ or Amount
Route Service Cost Center	Cost/Ton	I	II	III
	% Time on Route	IV	V	VI
	Man Minutes/Ton	VII	VIII	IX
Hauling Cost Center	Cost/Ton	X	XI	XII
	Tons/Equip. Hr.	XIII	XIV	XV
Repair & Maintenance Cost Center	Cost/Ton	XVI	XVII	XVIII
	Cost/Equip. Hr.	XIX	XX	XXI
	Parts Cost	XXII	XXIII	XXIV
	% Time Equip. Down	XXV	XXVI	XXVII
Collection & Haul Totals	Tons Collected	XXVIII	XXIX	XXX
	Total Cost	XXXI	XXXII	XXXIII
	Total Cost/Ton	XXXIV	XXXV	XXXVI

Disposal Operations	Factor	Total Tonnage
Disposal Cost Center	Cost/Ton	XXXVII
	Total Tons to Landfill	XXXVIII
	Tons Disposed/Labor Hr.	XXXIX
	Tons Disposed/Equip. Hr.	XXXX
Disposal Repair & Maintenance Cost	Cost/Ton	XXXXI
	Cost/Equip. Hr.	XXXXII
	Parts Cost	XXXXIII
	% Time Equip. Down	XXXXIV
Disposal Total Cost/Ton		XXXXV

Collection & Haul TOTAL	XXXXVI
Disposal TOTAL	XXXXVII
GRAND TOTAL	XXXXVIII

* Depreciation costs are not included in this form.

MONTHLY OPERATING COST SUMMARY OUTLINE

ROUTE SERVICE COST CENTER

I. Residential Cost/Ton (Exclude all commercial and bulky waste costs)

a) Labor costs (LC) - direct wages, overtime pay and fringe benefits (vacation pay, group life, medical insurance, social security payments and pension contributions) (Form #1)

LC = (% time on route from IV) x (Residential collection labor costs) = _____

b) Operation = Oil, lube & gas costs (Op.)
Op. = (% time on route from IV) x (Residential truck fuel, oil, and lube costs from Form #8) = _____

c) Overhead costs: Supervision (Superintendent's salary, foreman's salary, car costs for both men), administrative, department charges such as payroll costs, accounting costs and any other miscellaneous overhead items. Proportion according to number of employees in Residential route service cost center. See Example A below.

(Overhead cost) x (Proportioned %) = _____
TOTAL COST = a + b + c = _____

d) Total tons: Total tons collected by City residential trucks as taken from Form #2

$$\text{Residential Cost/Ton} = \frac{\text{Labor Costs + Operation + Overhead (a+b+c)}}{\text{Total tonnage (d)}}$$

Example A OVERHEAD PROPORTIONING

	No. of employees		*Proportioned %
Route Service Cost Center			
Residential employees	12	12/47 =	25%
Commercial employees	3	3/47 =	7%
Bulky Waste employees	4	4/47 =	9%
Hauling Cost Center			
Residential employees	12	12/47 =	25%
Commercial employees	3	3/47 =	7%
Bulky Waste employees	4	4/47 =	9%

(continued next page)

	No. of employees		*Proportioned %
Repairs and Maintenance - Estimate			
R & M employees used for coll. & haul vehicles			
Residential trucks	2	2/47 =	5%
Commercial trucks	1	1/47 =	1%
Bulky Waste trucks	1	1/47 =	1%
Disposal Cost Center			
Landfill employees	4	4/47 =	9%
Repair and Maintenance - Est. R&M employees used for disposal equip.	1	1/47 =	2%
			100% Must = 100%

* Keep constant each month and review figures annually.

II. Commercial Cost/Ton (City trucks only) (Exclude all residential and bulky waste costs)

Repeat I above using commercial labor costs (Form #1), commercial truck operation costs (Form #8) and overhead amount in proportion to commercial crew members. See V for commercial % time on route. Total tonnage for City commercial trucks taken from Form #2. Cost/ton divided as per I above.

III. Bulky Waste Cost/Ton (City trucks only) (Exclude all residential and commercial costs)

Repeat I using bulky waste truck labor costs (Form #1), operation costs for bulky waste trucks (Form #8) and overhead amount in proportion to bulky waste crew members. See VI for bulky waste % time on route. Total tonnage separated out for tramp trucks (Form #2). Cost/ton divided as per I above.

IV. Residential % Time on Route =

$$\frac{\text{monthly truck hours on route for residential crews (See Form \#3)}}{\text{monthly total residential truck hours (See Form \#3)}}$$

V. Commercial % Time on Route

Repeat IV using commercial route and truck times (Form #3)

VI. Bulky Waste % Time on Route

Repeat IV using bulky waste truck route and truck times (Form #3)

VII. Residential Man Minutes/Ton =

$$\frac{\text{(monthly truck hrs. on route for residential crews*) (60 min/hr) (No. of crew members)**}}{\text{Total tons collected by residential trucks***}}$$

VIII. Commercial Man Minutes/Ton =

$$\frac{\text{(monthly truck hrs. on route for commercial crews) (60 min/hr) (No. of crew members)}}{\text{Total tons collected by commercial trucks}}$$

IX. Bulky Waste Man Minutes/Ton =

$$\frac{\text{(monthly truck hrs. on route for bulky waste crews) (60 min/hr) (No. of crew members)}}{\text{Total tons collected by bulky waste trucks}}$$

HAULING COST CENTER

X. Residential Cost/Ton

a) Labor costs (LC) - direct wages, overtime pay and fringe benefits (Form #1). Same as computed in Ia above.

% time truck on haul = 100% - Residential % time on route from IV.

LC = (% time truck on haul) x (Residential collection labor costs) =_____

b) Operation = oil, lube and gas costs (Op.)

Op. = (% time on haul from Xa) x (Residential truck fuel, oil, and lube costs from Form #8) = _____

c) Overhead = Proportion according to number of employees in Residential Hauling Cost Center. See Ic.

(Overhead cost) x (Residential Haul Proportioned %) = _____
TOTAL COST = a + b + c = _____

d) Total tons: Total tons collected by City residential trucks as taken from Form #2 and shown in Id.

$$\text{Residential Cost/Ton} = \frac{\text{Labor Costs + Operation + Overhead (a+b+c)}}{\text{Total tonnage (d)}}$$

---

* Get from Form #3.
** Three for residential trucks - always include driver.
*** Get from Form #2.

XI. Commercial Cost/Ton

Repeat X above using commercial labor costs (Form #1), commercial truck operation costs (Form #8) and overhead amount in proportion to commercial haul crew members. Compute % time truck on haul by substracting % route time V from 100%. Total tonnage for City commercial trucks same as in II. Cost/ton divided as in X above.

XII. Bulky Waste Cost/Ton

Repeat X using bulky waste labor costs (Form #1), bulky waste truck operation costs (Form #8) and overhead amount in proportion to bulky waste haul crew members. Compute % time truck on haul by substracting % route time VI from 100%. Total tonnage for City bulky waste trucks same as in III. Cost/ton divided as in X above.

XIII. Residential Tons/Equipment Hours =

$$\frac{\text{Total residential tons collected (Form \#2)}}{\text{Total hours truck on haul - compute from Form \#3}}$$

100% - % time on route = % time on haul.

XIV. Commercial Tons/Equipment Hours =

$$\frac{\text{Total commercial tons collected (Form \#2)}}{\text{Total hours truck on haul - compute from Form \#3}}$$

XV. Bulky Waste Tons/Equipment Hours =

$$\frac{\text{Total bulky waste truck tons collected (Form \#2)}}{\text{Total hours truck on haul - compute from Form \#3}}$$

REPAIRS AND MAINTENANCE COST CENTER

XVI. Residential Cost/Ton

a) Labor and parts cost for residential trucks can be taken directly off Form #5. _____

b) Overhead costs should be proportioned as per no. of employees in R & M cost center as per Ic, example A. _____

c) Total tons: Total residential truck tonnage (Form #2) _____

$$\text{Residential Cost/Ton} = \frac{\text{Labor and Parts Cost + Overhead (a + b)}}{\text{Total tonnage (c)}}$$

XVII. Commercial Cost/Ton

Repeat XVI using commercial truck data from Form #5 and overhead costs proportioned as per Ic, Example A. Truck tonnage as per Form #2. Divide cost/ton as in XVI above.

XVIII. Bulky Waste Cost/Ton

Repeat XVI using bulky waste data from Form #5 and overhead costs proportioned as per Ic, Example A. Truck tonnage as per Form #2. Divide cost/ton as in XVI above.

XIX. Residential Cost/Equipment Hours =

$$\frac{\text{Total cost from XVI a + b}}{\text{Total hours residential equipment in use/month (Form \#3)}}$$

XX. Commercial Cost/Equipment Hours =

$$\frac{\text{Total cost from XVII a + b}}{\text{Total hours commercial equipment in use/month (Form \#3)}}$$

XXI. Bulky Waste Cost/Equipment Hours =

$$\frac{\text{Total cost from XVIII a + b}}{\text{Total hours bulky waste equipment in use/month (Form \#3)}}$$

XXII. Residential Parts Cost - Take directly from Form #5.

XXIII. Commercial Parts Cost - Take directly from Form #5.

XXIV. Bulky Waste Parts Cost - Take directly from Form #5.

XXV. Residential % Time Equipment Down =

$$\frac{\text{Total hours residential equipment down - per month from Form \#5}}{\text{Total residential truck hours as in Form \#3}}$$

XXVI. Commercial % Time Equipment Down =

$$\frac{\text{Total hours commercial equipment down - per month from Form \#5}}{\text{Total commercial truck hours as in Form \#3}}$$

XXVII. Bulky Waste % Time Equipment Down =

$$\frac{\text{Total hours bulky waste equipment down per month from Form \#5}}{\text{Total bulky waste truck hours as in Form \#3}}$$

COLLECTION AND HAUL TOTALS

XXVIII. Residential Tons Collected - Take directly from Form #2 for City residential trucks only. This amount should equal that in Id.

XXIX. Commercial Tons Collected - Take directly from Form #2 for City commercial trucks only as in IId.

XXX. Bulky Waste Tons Collected - Take directly from Form #2 for City bulky waste trucks only as in IIId.

XXXI. Total Cost (Residential) - Depreciation is not included here so this is total of I a + b + c plus X a + b + c plus XVI a + b.

XXXII. Total Cost (Commercial) - Total of II a + b + c plus XI a + b + c plus XVII a + b.

XXXIII. Total Cost (Bulky Waste) - Total of III a + b + c plus XII a + b + c plus XVIII a + b.

XXXIV. Total Cost/Ton (Residential) = $\frac{\text{Total Cost from XXXI}}{\text{Tons Collected from XXVIII}}$

XXXV. Total Cost/Ton (Commercial) = $\frac{\text{Total Cost from XXXII}}{\text{Tons Collected from XXIX}}$

XXXVI. Total Cost/Ton (Bulky Waste) = $\frac{\text{Total Cost from XXXIII}}{\text{Tons Collected from XXX}}$

DISPOSAL COST CENTER

XXXVII. Cost/Ton

a) Labor costs - direct wages, overtime pay and fringe benefit pay (Form #1), scaleman, landfill equipment operators, etc. _____

b) Operation - oil, lube, and fuel costs for landfill equipment only (Form #8) _____

c) Overhead costs - proportion according to number of employees at disposal site. See Ic, Example A. _____

TOTAL COST a + b + c = _____

d) Total tons: Total all refuse tonnage disposed at landfill including out-of-town refuse. Form #2.

$$\text{Disposal Site Cost/Ton} = \frac{\text{Total cost from XXXVII a + b + c}}{\text{Total tonnage from XXXVII d}}$$

XXXVIII. Total tons to landfill - Copy from XXXVII d.

XXXIX. Tons Disposed/Labor Hours =

$$\frac{\text{Tons disposed @ landfill from XXXVIII}}{\text{Total landfill labor hours Form \#1}}$$

XXXX. Tons Disposed/Equipment Hours =

$$\frac{\text{Tons disposed @ landfill from XXXVIII}}{\text{Total landfill equipment hours Form \#2}}$$

DISPOSAL REPAIRS AND MAINTENANCE COST CENTER

XXXXI. Cost/Ton

a) Labor and parts cost for scale and disposal site equipment can be taken directly off Form #5. _____

b) Overhead costs should be proportioned as per Ic, Example A. _____

TOTAL COST a + b = _____

c) Total tons taken from XXXVIII

$$\text{R \& M Cost/Ton} = \frac{\text{Total Cost a + b above}}{\text{Total tons c above}}$$

XXXXII. Cost/Equipment Hours =

$$\frac{\text{Total Cost as in XXXXI a + b}}{\text{Total landfill equipment hours (Form \#2)}}$$

XXXXIII. Parts Cost - Take directly from Form #5 for disposal equipment.

XXXXIV. % of Time Equipment Down =

$$\frac{\text{Total hours disposal equipment down per month from Form \#8}}{\text{Total disposal equipment hours per month from Form \#2}}$$

XXXXV. Total Cost/Ton = Total of XXXVII plus XXXXI

XXXXVI. Collection & Haul Total = Total of XXXI plus XXXII plus XXXIII

XXXXVII. Disposal Total = Total of XXXVII a + b + c plus XXXXI a + b

XXXXVIII. Grand Total = Total of XXXXVI plus XXXXVII

To compute the "Total Cost" of the "Commercial" collection, haul, and repair and maintenance operation on Form #7, the reference indicated for the outline explanation is XXXII. Section XXXII of the outline refers to outline Section II a + b + c, XI a + b + c, and XVII a + b. When referring to Sections II, XI, and XVII, they are not broken down into subsections a, b, or c. However, these sections refer to the outline procedures used in the steps preceding them or Sections I, X, and XVI. These sections do have subsections a, b, and/or c. Therefore, when actually computing the data for Sections II, XI, and XVII, they would be subdivided into a, b, and/or c as are Sections I, X, and XVI. This method was used throughout the outline to simplify the explanation of the form where repeating an explanation of a section would have been superfluous. (See example month for Form #7 in appendix.)

Most of the data collected has been tabulated and discussed in previous sections of this report. Additional information is contained in Table No. 7, on the following page, concerning Equipment Operating Costs. The increasing cost of operation as the equipment becomes older is apparent from this data. The 1971 truck and packer cost $0.125 per mile and $0.353 per hour to operate while the 1960 truck and packer cost $0.607 per mile and $2.315 per hour to operate. Replacing the landfill loader reduced the operating cost from $2.443 per hour to $1.433 per per hour.

TABLE NO. 7
AVERAGE EQUIPMENT OPERATING COSTS*

Equip. No.	Description**	Total Miles per Month	Total Hours per Month	Hours Down per Month	Cost*** per Month	Cost per Mile	Operating Cost per Hour
			ADMINISTRATION				
6	1964 Scout	426.8	143.8	3.8	$ 42.44	$0.099	$0.295
30	1965 Dodge (1/2 ton pickup)	518.4	146.5	4.4	46.53	0.090	0.318
			RESIDENTIAL AND COMMERCIAL COLLECTION (Trucks with Packers)				
91	1971 Dodge	809.9	286.6	11.6	101.10	0.125	0.353
27	1969 Dodge	474.7	207.4	11.1	198.57	0.418	0.958
31	1964 Ford	466.3	225.1	9.7	198.80	0.426	0.883
43	1962 Chevy	273.2	119.8	12.8	197.33	0.722	1.647
89	1960 International	414.5	108.7	13.5	251.49	0.607	2.315
28	1950 International	---	53.3	4.1	88.55	---	1.662
			BULKY WASTE COLLECTION				
16	1970 Ford	590.9	154.6	1.9	41.58	0.074	0.269
18	1970 Ford	595.8	153.4	1.5	36.70	0.062	0.239
			LANDFILL				
62	Euclid Loader (1962)	---	177.2	10.2	432.98	---	2.443
60	D-7 Cat.	---	145.6	8.0	137.11	---	0.942
45	Case Loader, W-26 (1971)	---	202.6	21.3	290.30	---	1.433

* Data shown covers period from July, 1969 to May, 1972 or shorter periods depending on actual equipment usage.

** See Page 15 (Table No. 2) and Pages 45 and 46 for equipment descriptions.

*** Cost per Month includes Mechanic's Labor, Parts Cost, Fuel Cost, and Oil and Lubricating Cost.

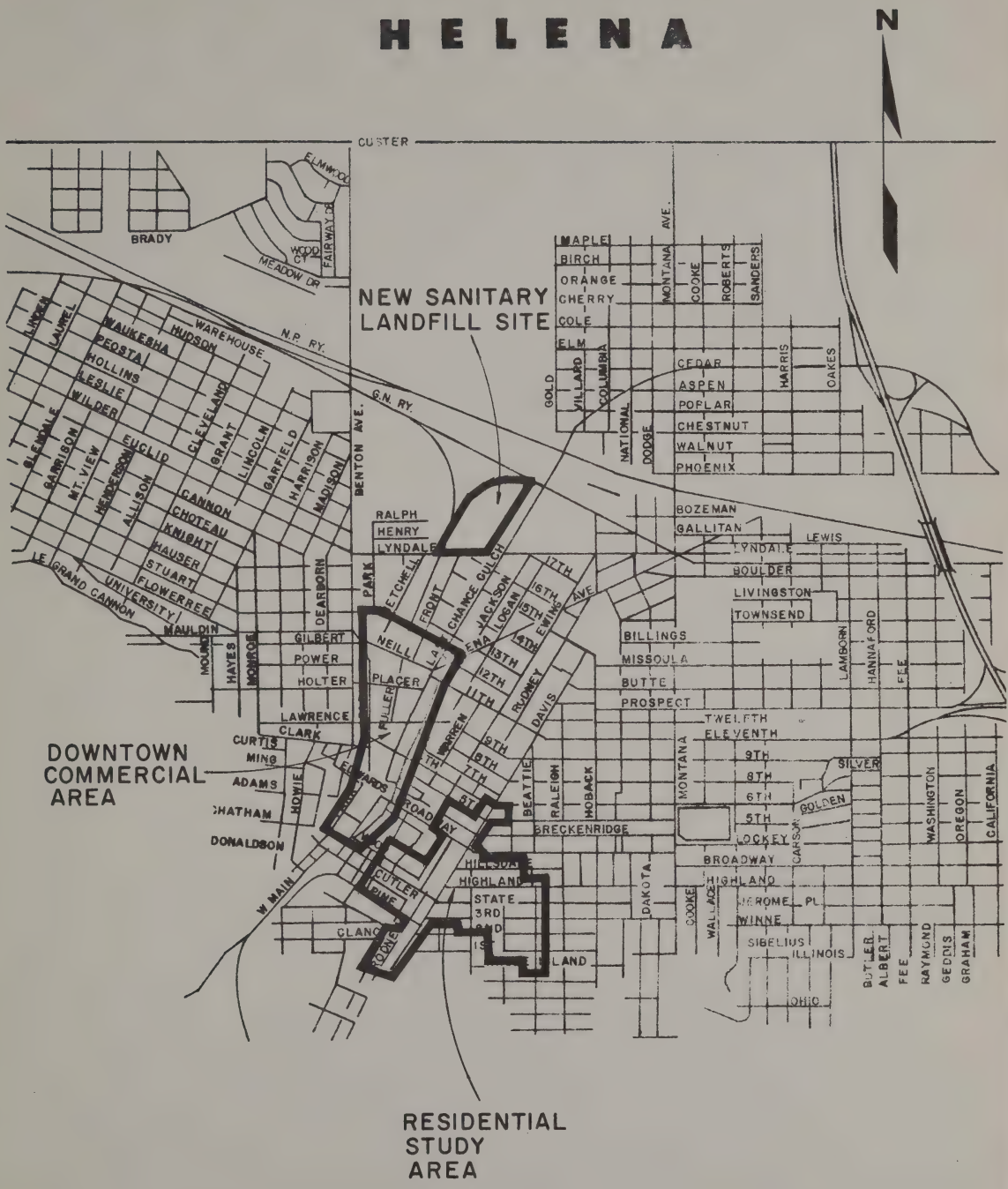
SECTION VIII - METHODS USED FOR PUBLIC EDUCATION

Meetings were held in the study areas with the individual residents and with the business owners and managers for the bulk storage sites. In addition to the meetings, questionnaires were periodically mailed to each of the individuals within the study areas. This has been discussed in the previous sections. In addition to these efforts, the City prepared a slide presentation which was given to the annual training session for sanitarians in Bozeman and also to local service groups in Helena. Mr. Walter Anderson, the City Manager, and Mr. Don Lewis, Sanitation Superintendent, made T.V. presentations. During these meetings, the details of the project were explained along with the goals and objectives of the program.

An article regarding the study was published in the monthly publication of "Montana League of Cities and Towns" during November of 1970. The Model Cities Program under way in Helena provided a portion of the funding for this project and helped promote and publicize the work being done.

The code enforcement program is a continual form of education to the homeowners through personal contact with them. The Helena solid waste ordinance was revised in early 1969. The ordinance sets requirements on racks and container sizes, responsibility of the homeowners, maintenance of the storage areas, and methods for dealing with violations of the code. Failure to comply with the code is a misdemeanor and allows for settlement in Police Court.

One of the most encouraging results of this solid waste program in Helena has been the interest shown by people all over the City. Upgrading of storage facilities has improved not only in the specific study areas but throughout the entire City. The reason for this was no doubt the result of an effective public education program.


HELENA
N
CUSTER
BRADY
ELMWOOD
WOOD CT.
FAIRWAY DR.
MEADOW DR.
NEW SANITARY LANDFILL SITE
WAREHOUSE
N.P. RY.
G.N. RY.
BENTON AVE.
MAPLE
BIRCH
ORANGE
CHERRY
COLE
ELM
MONTANA AVE.
COOKE
ROBERTS
SANDERS
GOLD
VILLARD
COLUMBIA
NATIONAL
DODGE
HARRIS
OAKES
CEDAR
ASPEN
POPLAR
CHESTNUT
WALNUT
PHOENIX
LINDEN
LAUREL
WAUKESHA
HUDSON
PEOSTA
HOLLINS
LESLIE
WILDER
GLENDALE
GARRISON
MT. VIEW
HENDERSON
EUCLID
ALLISON
CLEVELAND
GRANT
LINCOLN
GARFIELD
HARRISON
MADISON
GANNON
CHOTEAU
KNIGHT
HAUSER
STUART
FLOWERREE
UNIVERSITY
LE GRAND GANNON
MAULDIN
MOUNT
HAYES
MONROE
DEARBORN
PARK
RALPH
HENRY
LYNDALE
ETCHELL
FRONT
CHANCE GULCH
JACKSON
LOGAN
EWING
AVE.
17TH
16TH
15TH
14TH
13TH
12TH
11TH
10TH
9TH
8TH
7TH
6TH
5TH
4TH
3RD
2ND
1ST
BOZEMAN
GALLITAN
LYNDALE
LEWIS
BOULDER
LIVINGSTON
TOWNSEND
BILLINGS
MISSOULA
BUTTE
PROSPECT
LAMBORN
HANNAFORD
FEE
GILBERT
POWER
HOLTER
PLACER
NEILL
FULLER
WARREN
RODNEY
DAVIS
LAWRENCE
CLARK
CURTIS
MING
ADAMS
HOWIE
CHATHAM
DONALDSON
W MAIN
EDWARDS
BROADWAY
BEATTIE
RALEIGH
HOBACK
BRECKENRIDGE
HILLSPAN
HIGHLAND
STATE
CUTLER
PINE
CLARK
ROWE
DAKOTA
MONTANA
CARSON
TWELFTH
ELEVENTH
9TH
8TH
6TH
5TH
LOCKEY
BROADWAY
HIGHLAND
JEROME PL.
WINNE
SIBELIUS
ILLINOIS
OHIO
SILVER
GOLDEN
WASHINGTON
OREGON
CALIFORNIA
COOKE
WALLACE
BUTLER
ALBERT
FEE
RAYMOND
GEDDES
GRAHAM
DOWNTOWN COMMERCIAL AREA
RESIDENTIAL STUDY AREA
LOCATION MAP

SITE:_____ DATE:___/___/____

EMPLOYEE IDENT.	DAY 1		DAY 2		DAY 3		DAY 4		DAY 5		DAY 6		DAY 7		Individual totals	Note cause of absences, extra hours to be paid, etc.
	JOB*	HRS.	JOB	HRS.	JOB	HRS.	JOB	HRS.	JOB	HRS.	JOB	HRS.	JOB	HRS.		
TOTALS	X		X		X		X		X		X		X			XXXXXXXXXXXXXXXXXXXX

INSTRUCTIONS: Supervisor to complete this form daily. List all employees separately including temporary help. "HRS." refers to hours worked daily. "JOB" refers to the job description.* At the end of each week forward one copy to the payroll department and retain the original for further use.

*D = driver, L = loader, EM = equip. maint., BM = building maint., etc.

Form No. 2

DAILY TRUCK WEIGHT RECORD

Signature ______________________ Date ____/____/____

uck Ident.	Source	Type	Weight in	Weight out	Weight Refuse	Truck Ident.	Source	Type	Weight in	Weight out	Weight Refuse
otals	X	X	X	X		Totals	X	X	X	X	

Sources: R = Residential, I - Industrial, C = Commercial
Types: R = Rubbish, G = Garbage, P = Paper

Landfill Equipment

quip. Ident.	Hours in use	Hours Down	Remarks	Equip. Ident.	Hours in use	Hours Down	Remarks

Form #3

Daily Performance

Time in _____ Time out _____

Mileage in _____ Mileage out _____

Minutes taken off for lunch _____

Driver:

Loader:

Loader:

REMARKS

Date: ___/___/___

Truck # _____

Crew # _____

Net Time _____

Net Miles _____

Gas (gal.) _____

CHECK IF ABNORMAL

Eng. Temp. ☐

Oil Press. ☐

Ammeter ☐

Packer ☐

Other ☐

Time Start	Time Finish	Weight	Weighmaster Signature	Route #
			Total Weight	

INSTRUCTIONS: Time in, Time out, Mileage in, and Mileage out to be completed by foreman. All additional data to be inserted by the driver. Time start and time finish refer to the times garbage collection was actually begun and ended on each route or part of route serviced between trips to the disposal site.

Form #4

COMPLAINT NOTICE

Date Received: _____/_____/_____

Type of Complaint: _____

_____

_____

Street:_____

Copy to be completed by supervisor to employees involved.

Route _____ Loader: _____

Driver _____ Loader: _____

Form #5

DAILY REPAIR & MAINTENANCE RECORD

Garage_____ For Period: _____

Truck Ident.	Date	Odo. Mile-age	Type Service or Repair	Hours Down	Labor Hrs.	Parts Descript.	Labor Cost	Parts Cost	Out-side Charge	Total Cost
TOTALS	X	X	X			X				

Form #6

CREW PERFORMANCE EVALUATION

Garage _____ For week of _____

Type	Total Working Hrs.	Hrs. on Route	Hrs. on Haul	Tons Collected	On Route Man Minutes/Ton
RESIDENTIAL WASTE					
COMMERCIAL WASTE					
BULKY WASTE					
DISPOSAL CREWS					
TOTALS					
AVERAGE					

MONTHLY OPERATING COST SUMMARY

Form #7
(Revised)

For Period: From: _____ To _____

Collection & Haul Operations:	Factor	Residential $ or Amount	Commercial $ or Amount	Bulky Waste $ or Amount
Route Service Cost Center	Cost/Ton			
	% Time on Route			
	Man Minutes/Ton			
Hauling Cost Center	Cost/Ton			
	Tons / Equip. hr.			
Repair & Maintenance Cost Center	Cost/Ton			
	Cost/Equip. hr.			
	Parts Cost			
	% Time Equip. Down			
Collection & Haul Totals	Tons Collected			
	Total Cost			
	Total Cost/Ton			

Disposal Operations	Factor	Total Tonnage
Disposal Cost Center	Cost/Ton	
	Total Tons to Landfill	
	Tons Disposed/ Labor Hr.	
	Tons Disposed/ Equip. Hr.	
Disposal Repair & Maintenance Cost Center	Cost/Ton	
	Cost/Equip. Hr.	
	Parts cost	
	% Time Equip. Down	
	TOTAL COST/TON	

Collection & Haul TOTAL	
Disposal Total	
GRAND TOTAL	

Revised 12-1-70

Month of: _____ Yr. _____

Equipment Identification	Total Miles	Total Hours	Hours Down	Mechs. Labor	Parts Cost	Fuel Cost	Oil & Lube. Cost	Repair & Maint. Per/Hr.	Fuel Cost Pr/Hr.	Total Cost /hr.	Total Cost
TOTALS								X	X	X	

Form 9

DATE: _____
(for use by acctg. dept. only)

TYPE	CAPACITY (cu. yds.)	MODEL NO.	MODEL YEAR	MFG. NAME	DATE OF PURCHASE	PURCHASE PRICE	EST. LIFE	ANNUAL DEPRECIATION	MONTHLY DEPRICIATION
COLLECTION & HAUL:									
Residential Equipment									
Commercial Equipment									
Bulky Waste Equipment									
DISPOSAL:									
TOTAL	X	X	X	X	X		X		

INSTRUCTIONS: To be filled out by accounting dept. or supervisor. "EST. LIFE" should be based on supervisor's estimate of remaining life. Depreciation may be on a straight-line or accelerated basis.

FACILITY INVENTORY

Date: _____

(For use by acctg. dept. only)

	ITEM	CATEGORY *	DESCRIPTION	DATE PUT IN USE	NEW COST	EST. TOTAL LIFE	OTHER COMMENTS	ANNUAL DEPRECIATION	MONTHLY DEPRECIATION
FACILITIES	Land					X		XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXX
	Buildings								
	Garages								
	Roads								
	Lights								
	Fences								
	Surveys								
	Scales								
	Other								
	TOTALS	X	X	X		X	X		

INSTRUCTIONS: To be completed by supervisor or accounting dept., if they have data available.
"EST. TOTAL LIFE" should be based on remaining life as estimated by the supervisor.
Depreciation may be either straight-line or on an accelerated basis.

*CATEGORY: Residential collection and haul equipment - R.C.&H., Commercial collection and haul equipment - C.C.&H., Bulky waste collection and haul equipment= B.W.C.&H., Disposal Equipment = D.

Form #11

TOTAL COLLECTION AND DISPOSAL COST SUMMARY

DISTRICT:_____ PERIOD OF REPORT: From _____ to _____

DATA	FOR THIS PERIOD	BUDGET-THIS PERIOD	YEAR TO DATE	BUDGET -YEAR TO DATE
RESIDENTIAL COLLECTION				
TONS OF REFUSE COLLECTED				
Total Operating				
Total Depreciation Cost				
TOTAL COST				
Operating Cost per Ton				
Depreciation Cost per Ton				
TOTAL COST PER TON				
COMMERCIAL COLLECTION				
TONS OF REFUSE COLLECTED				
Total Operating				
Total Depreciation Cost				
TOTAL COST				
Operating Cost per Ton				
Depreciation Cost per Ton				
TOTAL COST PER TON				
BULKY WASTE COLLECTION				
TONS OF REFUSE COLLECTED				
Total Operating				
Total Depreciation Cost				
TOTAL COST				
Operating Cost per Ton				
Depreciation Cost per Ton				
TOTAL COST PER TON				
DISPOSAL				
TONS OF REFUSE COLLECTED				
Total Operating				
Total Depreciation Cost				
TOTAL COST				
Operating Cost per Ton				
Depreciation Cost per Ton				
TOTAL COST PER TON				

INSTRUCTIONS: To be completed by the accounting dept. from data available in operating cost report, capital cost reports when requested, or periodically. Copies sent to City Manager.

MONTHLY OPERATING COST SUMMARY AVERAGES

Form #7
(Revised)

For Period: From: Dec. 1970 To May 1972

Collection & Haul Operations:	Factor	Residential $ or Amount	Commercial $ or Amount	Bulky Waste $ or Amount
Route Service Cost Center	Cost/Ton	$ 9.15	$ 7.63	$ 14.31
	% Time on Route	77	77	73
	Man Minutes/Ton	133	118	221
Hauling Cost Center	Cost/Ton	$ 3.20	$ 2.57	$ 6.78
	Tons / Equip. hr.	4.7	4.8	1.4
Repair & Maintenance Cost Center	Cost/Ton	$ 0.83	$ 0.26	$ 0.46
	Cost/Equip. hr.	$ 0.53	$ 0.32	$ 0.19
	Parts Cost	$ 336.20	$ 23.77	$ 7.54
	% Time Equip. Down	4.9	5.1	2.8
Collection & Haul Totals	Tons Collected	640	198	94
	Total **Cost**	$8435.00	$2071.00	$2026.00
	Total **Cost/Ton**	$ 13.18	$ 10.46	$ 21.55

Disposal Operations	Factor	Total Tonnage
Disposal Cost Center	Cost/Ton	$ 1.18
	Total Tons to Landfill *	1649
	Tons Disposed/ Labor Hr.	6.0
	Tons Disposed/ Equip. Hr.	14.5
Disposal Repair & Maintenance Cost Center	Cost/Ton	$ 0.17
	Cost/Equip. Hr.	$ 1.21
	Parts cost	$159.10
	% Time Equip. Down	9.5
	TOTAL COST/TON	$ 1.35

Collection & Haul TOTAL	$12,532.00
Disposal Total	$ 2,226.00
GRAND TOTAL	$14,758.00

* Excludes demolition waste

Date: August 3, 1972

(For use by acctg. dept. only)

	ITEM	CATEGORY *	DESCRIPTION	DATE PUT IN USE	NEW COST	EST. TOTAL LIFE	OTHER COMMENTS	ANNUAL DEPRECIATION	MONTHLY DEPRECIATION
FACILITIES	Land			June 1970	20,000.00	X		XXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXX
	Buildings	D	Scale House	Sept 1970	20,580.60	20 yrs.		$1,029.03	$857.52
	Garages								
	Roads								
	Lights								
	Fences			June 1970	1,245.39	3 yrs.		415.13	34.59
	Surveys								
	Scales								
	Other	D	Drainage Pipe	June 1970	44,247.48	40 yrs.		1,106.18	921.82
	TOTALS	X	X	X		X	X		

INSTRUCTIONS: To be completed by supervisor or accounting dept., if they have data available.
"EST. TOTAL LIFE" should be based on remaining life as estimated by the supervisor.
Depreciation may be either straight-line or on an accelerated basis.

*CATEGORY: Residential collection and haul equipment = R.C.&H., Commercial collection and haul equipment= C.C.&H., Bulky waste collection and haul equipment= B.W.C.&H., Disposal Equipment = D.